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Behind id Software's
Ultrasuccessful Game



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Paced Applications
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Network Survival:
PC Labs Tests 7
LAN Management
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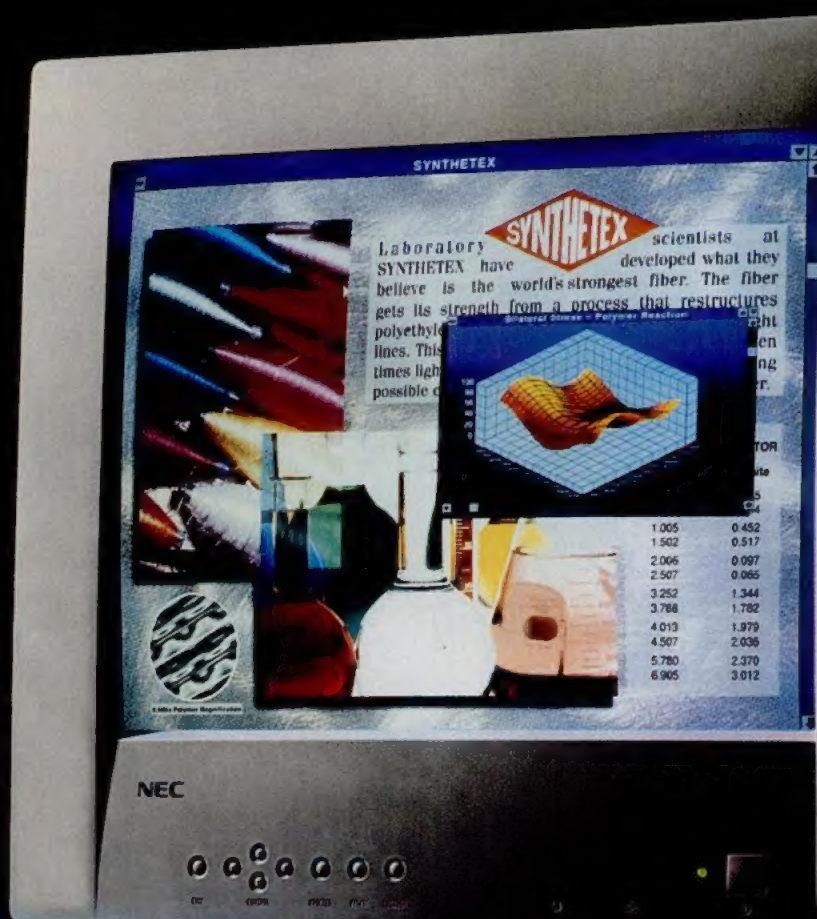
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Inside

W

hen it comes to computer equipment, everyone has a different way of calculating a bargain. There's the forget-about-bargains school that says the machine you want is always \$5,000.

There's the rule-of-thumb school that

says if you need to upgrade more than one component in your machine, you'd better buy a new machine. Then there's the school I come from, where I was taught that there is no such thing as a bargain. When it comes to processor upgrades, I might be right.

In this issue we ask a question you can't afford to leave unanswered: Is upgrading your PC a frugal or a foolhardy move? To find the answer, our PC team, headed by John Clyman and Rich Fisco, closely examine the myriad possibilities for breathing life into old PCs. They test the clock-doubled CPU upgrades from Cyrix and Intel. They explore the pros and cons of motherboard swaps and weigh the merits of CPU upgrades versus graphics and RAM upgrades. From compatibility to price/performance issues, our story "New Life for Old PCs" may cause you to rethink your definition of a bargain—especially when prices are dropping so quickly.

We're also proud to bring you the results of our first annual Shareware Awards Contest. We spent a few fun-filled weeks this summer poring over nearly 500 en-

tries for the contest. The winners and finalists are all listed in this issue; the programs are available for downloading on ZiffNet. Without spilling the beans, let me say that the winner—a game that sin-



glehandedly brought many a network to its knees—is given an in-depth look in our PC Tech section.

And whether you program or not, you'll want to read "RAD-ical Developments," a look at the latest, truly innovative crop of tools for developing applications. Easy to learn but capable of creating large client/server applications, these packages may be the ultimate bargain, spurring a new generation of database-centric applications.—Robin Raskin

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Is the Cyrix 386-to-486 Upgrade Chip really that good? Just ask anybody.

“

Simply plug in the Cyrix 486 upgrade to a 386 motherboard and you'll crank up performance by better than 60%...”

—PC Computing, November 1993¹

“True to the company's word, we found Cyrix's DRx² an easy upgrade that can deliver a performance boost (to your) wheezy old 386.”

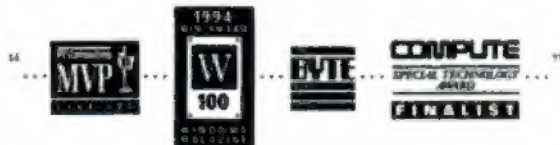
—Computer Shopper, February 1994¹

“This Cyrix upgrade is easily fitted in 15 min, and then the user is up and running with all the old software and data files unaffected. There is no learning curve or disruption for the user—it is only necessary to get used to the fact that the computer does everything twice as fast as before.”

—Personal Computer Magazine (UK), November 1993

“The Cyrix Cx486SRx² 386SX upgrade chip cleverly does something which everyone thought was impossible...a single-chip upgrade for 386SX machines...”

—Personal Computer Magazine (UK), January 1994



“Priced at under \$300, the upgrade will nearly double the performance of that creaky old 386SX a few of you still use.”

—PC Magazine, February 8, 1994¹

“Cyrix's clever design makes it possible to upgrade nearly any 386 in existence, without hassle or high cost...All you need is a fast, affordable upgrade for an office of 386s. The Cyrix Cx486SRx² is it. Just plug it into your s386 system and go.”

—PC Computing, December 1993¹

“Cyrix's solution is simple. You remove the existing 386 chip from its socket, plug in the Cx486DRx² and run some software.”

—PC Magazine, October 13, 1993¹

“Cyrix has developed inexpensive upgrade chips for 386-class personal computers...and the effect will be like dropping a Corvette engine into a Ford Escort...We decided to try one of the Cyrix chips. The result was impressive...Think about how much a small company could save.”

—Barry Cooper, The Orlando Sentinel, February 10, 1994

“Another potentially interested Cyrix customer is the corporate buyer... The buyer's budget can't handle 20 new 486-class PCs, and there isn't the time to do motherboard swaps on all of them, either. Enter Cyrix and the quick-and-easy 40-65 percent performance-boost solution.”

—Computer Shopper, February 1994¹

“...dropping in a Cyrix Cx486DRx² Upgrade Microprocessor is a quick way to really push performance.”

—WordPerfect the Magazine, December 1993

“...Cyrix gives new life to older 386SX- and 386DX-based computers...This may be the best upgrade solution we've seen yet for users of older machines who don't want to shell out \$1,500 or more to move into a new 486-based system.”

—Windows Magazine, The Win 100: The Best Windows Products of the Year, February 1994¹

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Cyrix instead

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NEW VERSION 5.0

Paradox

The screenshot displays the Paradox 5.0 for Windows interface. The main window is titled 'Paradox for Windows - [WorldOptics Order Entry System]'. It features a menu bar (File, Edit, View, Form, Record, Properties, Tools, Window, Help) and a toolbar. The interface is divided into several sections: a 'Customer' section with fields for Contact Name (Loren Hiday), Telephone (+44-71-123456), and Company Name (The Camera Shop); an 'Order' section with a table of orders (Order No, Date, Total Amount, Status); and three product sections: 'Camera' (showing a camera image), 'Filters' (showing two circular filters), and 'Video Camera' (showing a video camera image). Each product section has a table with columns for Qty, Unit Price, and Total Price. A 'World OPTICS' logo is prominently displayed in the center. At the bottom, there are buttons for 'New Order', 'Find Customer', 'Delete Order', 'Print Invoice', 'Upload Orders', and 'Graph Sales'. To the right, a smaller window shows a WordPerfect document with a letter from Andrew H. Broan to Loren Hiday, mentioning the camera and filters.

New version is easier than ever

The new Paradox® 5.0 for Windows is here, and managing your business data and building database applications just got faster and easier. New Interactive Coaches quickly teach you how to accomplish any task, while working with your own "live" data. On-line Experts™ guide you step-by-step in creating professional-looking forms, reports, and mailing labels. Even your largest data management tasks will be completed with unbelievable speed and accuracy.

More speed, developer enhancements, and Client/Server connectivity

New Paradox 5.0 for Windows has been tuned to give you the highest possible performance. It stores and retrieves data faster. Delivers answers to queries faster. And for Paradox developers, there's

Comparison Facts

End-user Features	Paradox 5.0	Access 2.0
Built-in computer-based training	✓	
Integrated graphics	✓	
Built-in workgroup and mail capabilities	✓	
Quick Filter without Query Process	✓	
Power-user/Developer Features		
OLE 2.0 client and server support	✓	
Compatibility with applications from previous version	✓	
Transparent connectivity and scalability with database aliases	✓	
Record level locking	✓	
Graphical Integrated Development Environment (IDE)	✓	
ODBC-compliant	✓	✓
Dedicated high-performance native SQL drivers	✓	

a new Integrated Development Environment and more than 300 new ObjectPAL™ Methods and Properties that help you develop Windows applications in record time. Plus, with the new native SQL drivers, Paradox is ready when you are to upsize your applications to the Client/Server environment.

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Full client and server support for OLE 2.0 and DDE make Paradox for Windows the best database for use with other applications including Perfect Office and Microsoft Office. For example, place a "live" Paradox table directly into a Word document, and edit it in place. (Can't do that with Access.)

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COVER STORY

Processor Upgrades

New Life for Your Old PC?



BY WINN L. ROSCH When you're thinking of replacing your old PC, you have a couple of choices: Buy that sleek new system—or put off the investment and upgrade aging components. But can a new CPU or a whole new motherboard match the performance or the [value of the aggressively priced new machines? ... 110](#)

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RADical Development

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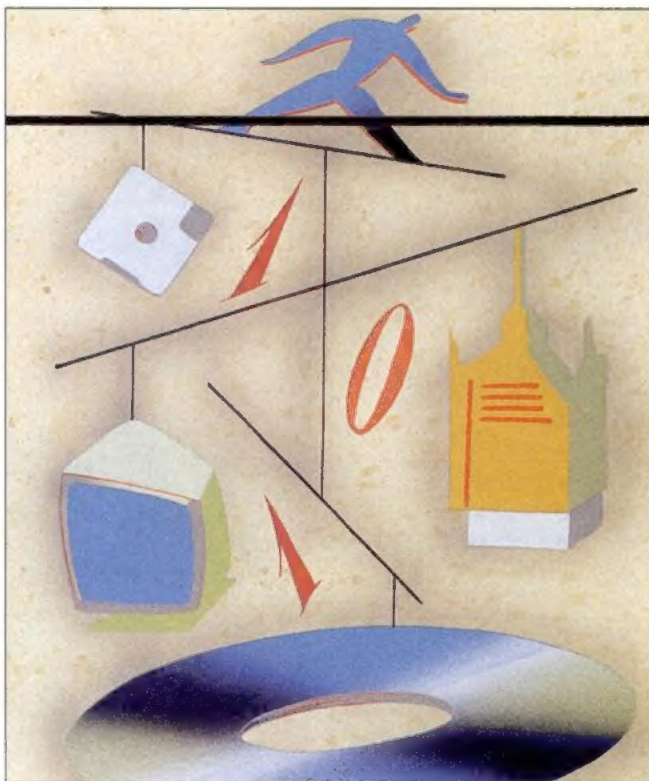
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Business Tools:
The Manager's
Toolkit

BY LANCE ULANOFF You don't need an M.B.A. to be a successful manager. The software we review can help you plan and forecast your business effectively.213

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Networking

Network Management:
Who's Minding Your Network?

BY FRANK J. DERFLER, JR. Keeping your network running at its peak is your job. But you don't have the time to monitor it all day long, and managing critical network resources requires a lot of different software tools. Suites, or lines of network management utilities, can be proactive in helping you avoid trouble—but their state of development varies. Some suites offer a consistent interface; some include a shared database that lets utilities share information and work together. *PC Magazine* has rounded up seven network management suites that offer essential network management functions. We test each utility and also assess the suite's overall integration.....237

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Dual Connectivity	yes	no	no	no

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PC Magazine Reviews

Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 486/33M's.

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"The Nokia Multigraph 447X's supremely sharp picture and clever on-screen menu controls make it a winning choice among 17-inch color displays."

PC Magazine

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"The Multigraph 447X showcases the latest monitor technology...focus is crisp and colors are rich and uniform."

PC Computing

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PC Magazine

Editors' Choice-PC Magazine 9/94.

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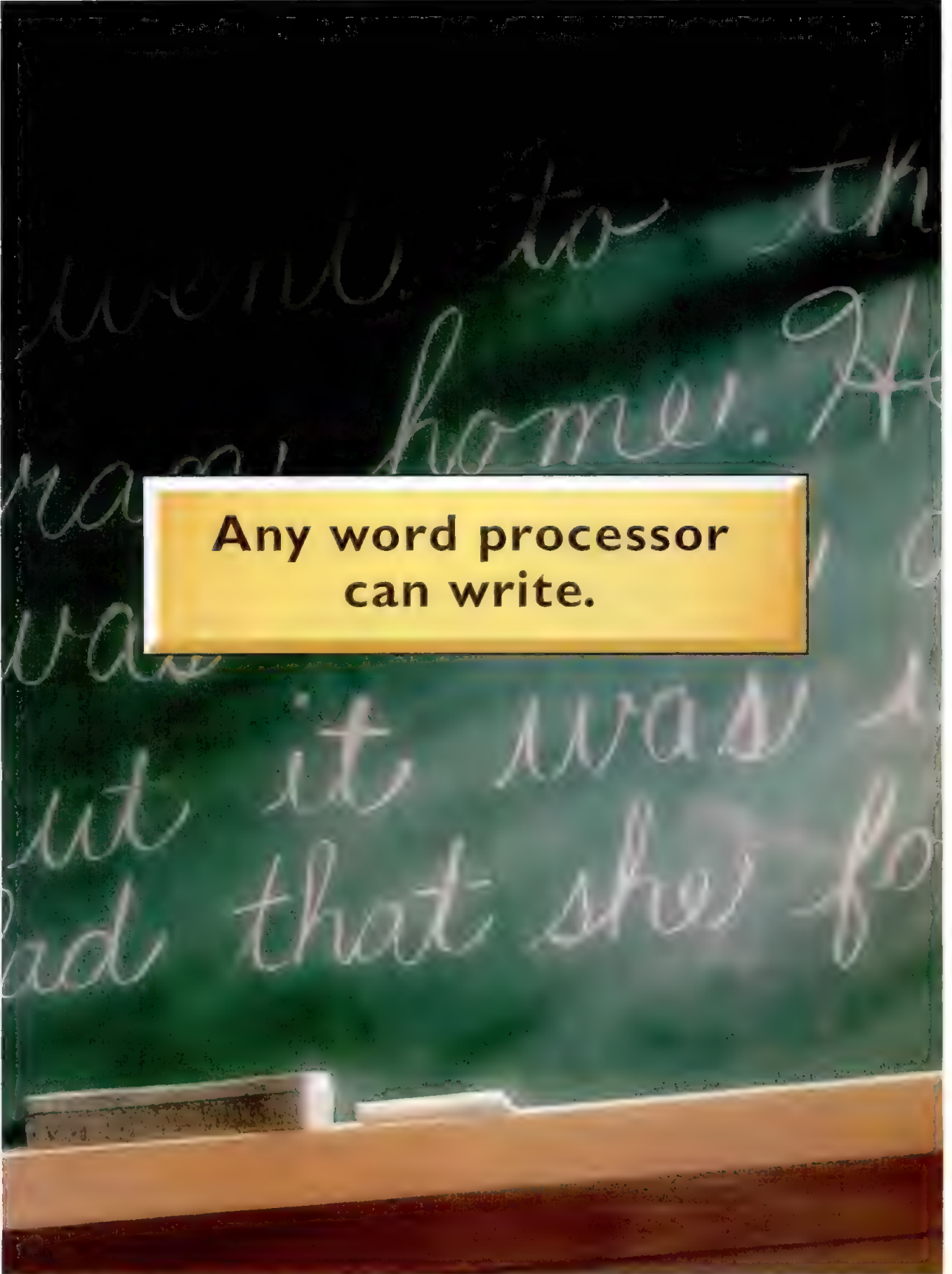
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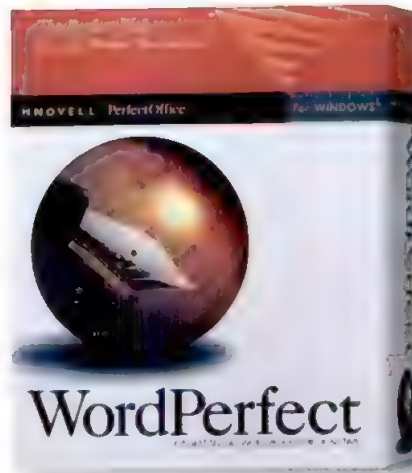
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NOKIA
CONNECTING PEOPLE

A green chalkboard with cursive handwriting in white chalk. The text on the board is partially obscured by a yellow rectangular box in the center. The visible text includes "went to the", "home. He", "it was", and "that she fo".

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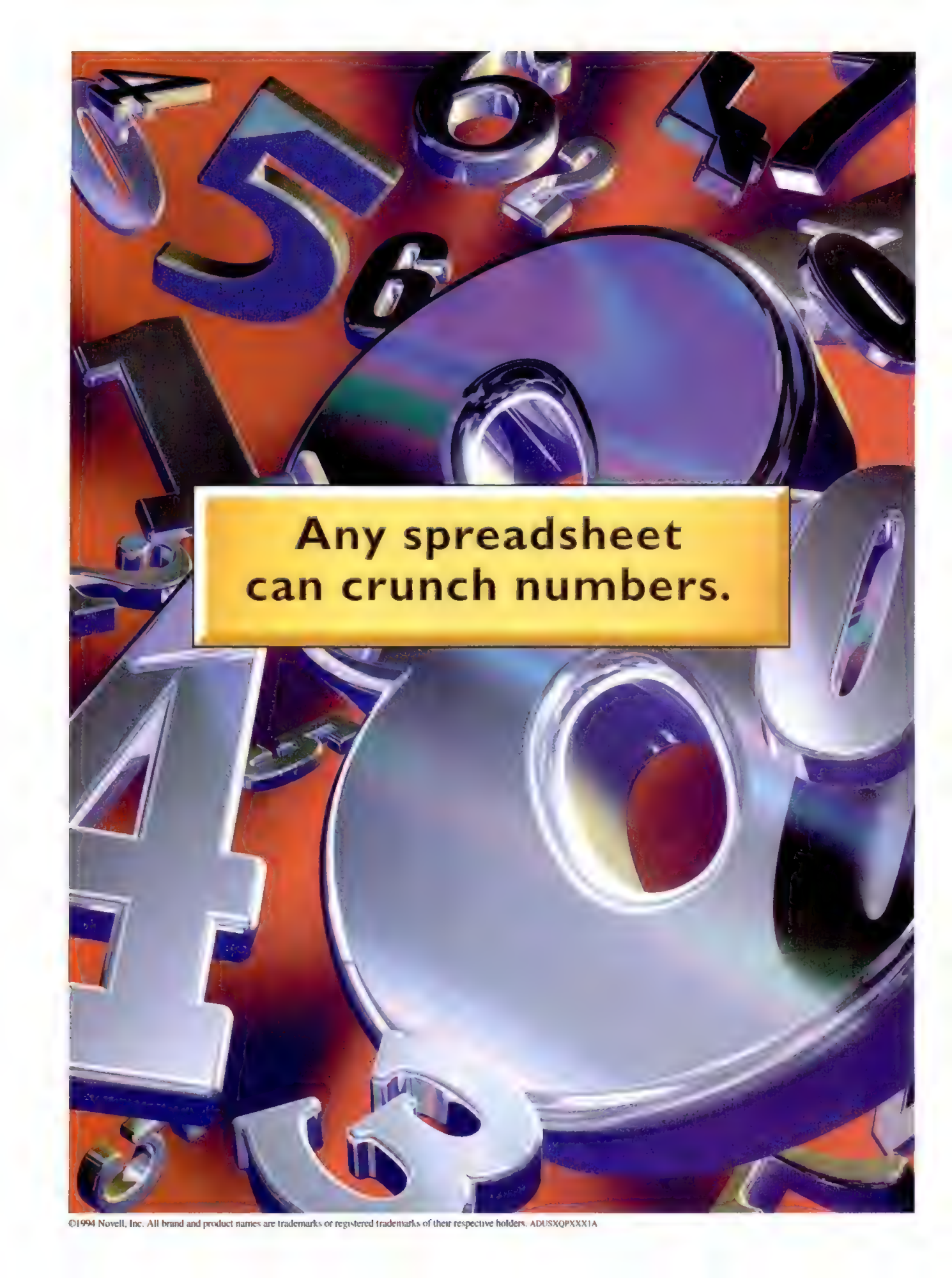
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**Barbara Stump
Network Administrator
Systech Environmental Corporation:**

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BARBARA STUMP, SYSTECH ENVIRONMENTAL CORPORATION

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Letters

SEARCHING FOR PERFECTION

You've done it to me again! Two years ago, armed with *PC Magazine's* Perfect PC issue, I convinced my boss to replace my four-year-old 286 with a 486 DX/33 that had 4MB of RAM and a 230MB hard disk. But after reading your latest Perfect PC installment ("Picking the Perfect PC," July 1994), I find myself thinking, "Should I go for a Pentium, or will a 486DX4/100 with 16MB of RAM and a 500MB hard disk be sufficient. Of course, a CD-ROM and a fax/modem are essential, and while I'm at it, I'll throw in a PCMCIA slot for notebook compatibility. Now all I have to do is convince my boss that my 18-month-old PC is obsolete. I can hear the pitch now: "But boss, I am saving money—I didn't order the sound card!"

*John A. Musolino
Melville, New York*

The July 1994 cover story, "Picking the Perfect PC," was thoroughly enjoyable. Kudos on a perfect issue, especially for someone who's in the market for a new computer.

*Chris Mardorf
via PC MagNet*

The Perfect PC issue is a winner! This was easily the most informative issue I've ever read, and I learned so much that my colleagues consider me a computer maven.

*Matt Cole
Williamsville, New York*

Your unqualified recommendation of motherboards incorporating on-board serial ports and an integrated hard disk controller is curious. Having worked as an authorized reseller and repair dealer, I've found that such port and drive controllers are the ones that are the most frequently repaired or even replaced parts in any given system. The natural consequence of such a highly integrated board as you promote is that you'd need to replace the motherboard for what could amount to the very slightest system-component failure.

A better recommendation might have been motherboards with built-in jumpers



*Just convince the boss
that your 18-month-old
PC is obsolete.*

or switches that permit users to disable the various integrated component controllers and ports. Although replacement or upgrade controllers would use additional slots in the event of an on-board failure, buying a new board is far more costly.

*Douglas M. Bade
via the Internet*

• **Most motherboards allow you to disable built-in I/O devices such as serial or parallel ports, so in the case of a failure, you can repair the unit by adding a \$25 I/O ISA card.—Ed.**

It never fails. Once again, your definition of the Perfect PC makes me hate my current investments in hardware.

*Conrad A. Maxwell
via PC MagNet*

That your analysis of what constitutes the Perfect PC included no mention of the new series of Apple PowerBooks was surprising. These machines represent a breakthrough in design, both technologically and aesthetically, and will have an impact on future Apple and PC designs.

*Frank Reitz
via the Internet*

SETTING THE SERVICE RECORD STRAIGHT

We are disappointed with *PC Magazine's* most recent coverage of service and reliability ("The Perfect PC: Service & Reliability," July 1994). Unlike other PC makers whose grades took a downturn, we were not given the opportunity to give our side of the story. Had your staff sought to call us for comment, we would have acknowledged our bankruptcy-related problems, including shipping delays, parts shortages, and lags in the turnaround time required for notebook repairs.

A year after we emerged from bankruptcy, however, CompuAdd sales are on the upswing. Our overall response to customer repairs in 1994 is exemplary, with 95 percent of all repairs being done within 48 hours. Our customers averaged a 34-second hold time for technical support between November 1993 and May 1994 (compare that with the A rating IBM received for an average hold time of 2.5 minutes 60 percent of the time). Thanks for the belated opportunity to set the record straight.

*Richard W. Krause
Chairman and Chief Executive Officer
CompuAdd Computer Corp.
Austin, Texas*

EMPATHETIC SUPPORT

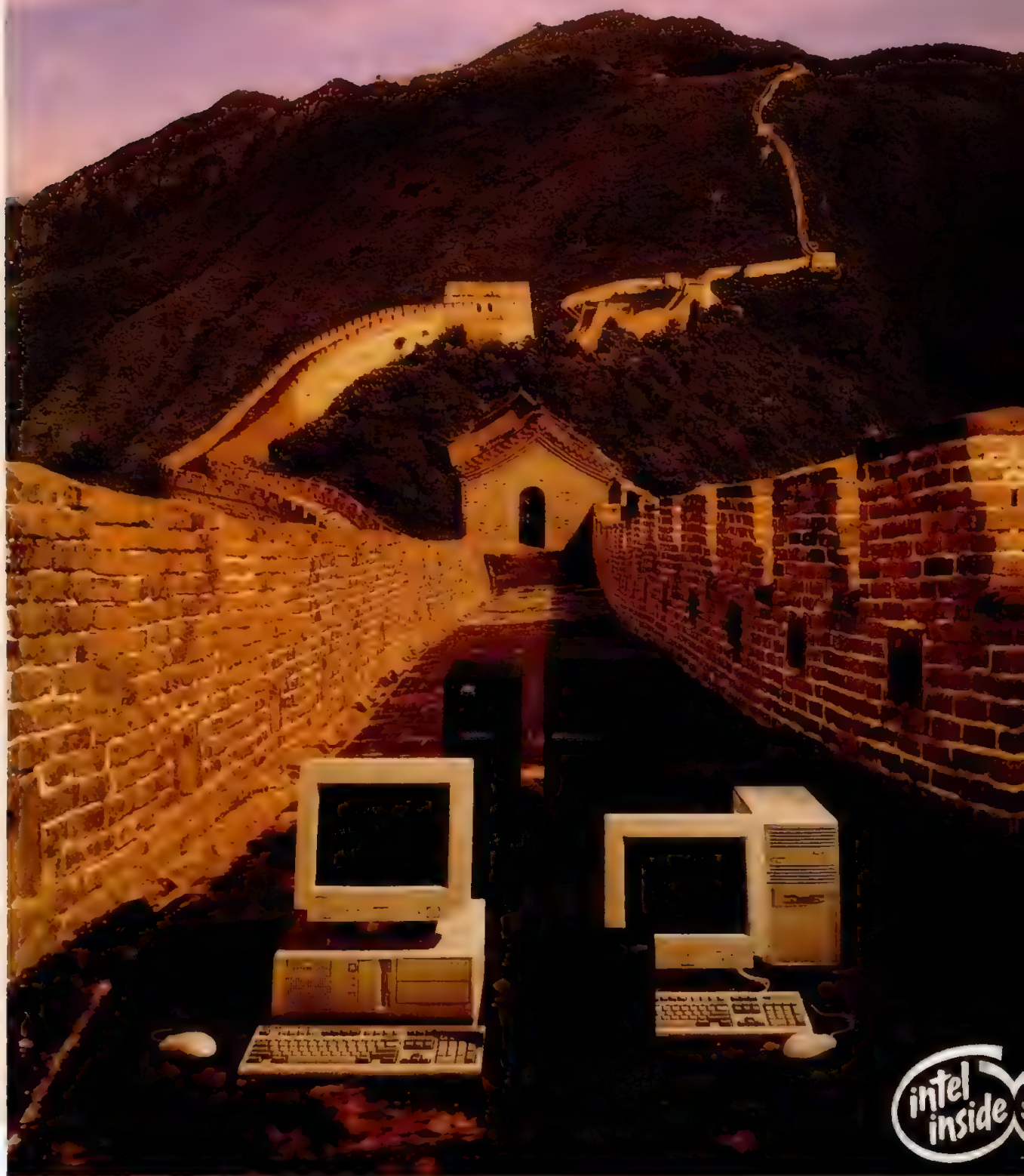
The articles "The Perfect PC: Support & Satisfaction" and "Report on Support, Part I" (July 1994) both rang familiar, in more than one way. Ever since I became involved with computers, I've been annoyed that technical-support people not only don't answer my questions correctly and promptly, but that they're often so unfamiliar with the uses of their products that they don't even understand my questions! It's bad enough that the manuals and online help are badly written, badly organized, and inadequately indexed, but if I'm desperate enough to need help, I want my questions at the least to be understood.

*Ken Moses
Mercerville, New Jersey*

CLIPPING CLIPPER'S WINGS

Michael Miller's column on the Clipper chip ("What Would George Orwell Say?"

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LETTERS

July 1994) was sorely needed. Too much of the writing on the Clipper issue has followed the "only criminals have anything to hide" line of thinking. However, one aspect of the whole controversy was omitted: If Clipper is adopted without simultaneously outlawing other means of encryption, there's nothing to prevent me from encrypting my messages and then running the cyphertext through Clipper. This has the advantage of making the fact that I am using superencryption invisible to anyone other than my correspondent, who has the escrowed keys. Concealing messages under a layer of Clipper only improves security.

Monty J. Harder
via the Internet

Miller's column brings home the point that computer technology, which has become so essential in today's society, is also slowly chipping away at our individual right to privacy. It's not enough that the IRS can ruin a person or company without the burden of proof. Now we have to worry about who else might be watching or listening to us when we go about our daily jobs.

Paul L. Oberholtzer
Morrow, Georgia

Don't get me wrong—I am not a fan of Big Brother, and I care a lot about my right to privacy. But it seems to me that Clipper, as it relates to privacy, is really a non-issue. Those who have something to hide, or who are simply sufficiently paranoid, will pre-encrypt their messages and will be secure no matter what the federal government does. Those who find today's level of communication security sufficient will find tomorrow's no worse. Considering that, today, all telephone communication is completely open and unencrypted, having our data communication encoded by a chip that the government can tap will make us no less secure than we are now.

John Carlson
via PC MagNet

There may be no real guarantee that any key will remain secure for long, but I believe the Clipper chip has merit—some across-the-board encryption is more se-

cure than none. Sure, the government will have the ability to listen to our conversation, and no doubt some agencies will take extra liberties with our privacy, but then again, the government has no doubt been doing so all along. What will be severely inhibited is the ability of others to stick their noses in.

William Clark
via the Internet

UTILITIES FOREVER ON THE NET

Robin Raskin observed there were at least 25 locations on the Internet where *PC Magazine's* software utilities could be "illegally" downloaded (Pipeline, "Publish or Perish, Internet Style," July 1994). The wording of Raskin's column seemed to indicate there was malicious intent behind this "piracy," even though the utilities have long been made available on the Internet.

Peter Kukla
via the Internet

For nearly ten years, I've been downloading *PC Magazine's* utilities free from BBSs and the Internet. These utilities are one of *PC Magazine's* pillars of strength, and I fervently hope that *PC Magazine* continues to distribute its utilities as freeware.

Harry M. Kriz
via the Internet

• The many letters we've received regarding *PC Magazine's* distribution of utilities underscores the reach of the Internet and the power of the written word. To clarify, *PC Magazine's* World Wide Web server is not intended to be the sole source of *PC Magazine* utilities on the Internet. Posting *PC Magazine* utilities on the Internet and elsewhere is welcomed; though copyrighted, our utilities may be copied and distributed so long as no charge is involved. The *PC Magazine* utilities are available as a public service to our readers, and we at *PC Magazine* are committed to providing these utilities at no charge.—Ed.

COLORFUL PAGES

Hmmm...would Bill Howard follow his own advice ("For Affordable Color, Think Ink," July 1994) and submit his column printed on an ink jet printer? Let's face it: The majority of our printing tasks in both the home and the office are text-based, and an ink jet's near-laser quality just doesn't

come close to the Real McCoy—it doesn't give a document the professional quality that a true laser printer does. Color printing may add impact to your documents, but it comes down to pizzazz or professionalism.

Steve Supkoff
via the Internet

PATENT ISSUES

In a letter to the editor, Mr. Steve Ahola (Letters, July 1994) expresses a fear that courts will "tie...third-party developers' hands" and "[stifle] the evolution of software products" should the courts rule against reverse engineering of certain software inventions. Readers should understand that the courts do not function in a vacuum. Rather, the courts interpret existing law, both statutory and case law, with the present case in mind. If the statutes prohibit such reverse engineering, then it is for Congress to amend or repeal the statute. Judges can do no more than decide who has the better argument between the opposing parties.

James R. Coleman, J.D.
via the Internet

THERE'S ALWAYS ANOTHER WAY

Bill Machrone's column "Thinking: You're Doing It Wrong" (July 1994) raises a worthy issue. The present and ongoing battle of the operating systems is based as much on performance capability as it is on user interface. Machrone rightly notes that the user interface embodies, reflects, and creates a mode of thought, but to an extent, it also defines an era of computing.

R.N. Wisan
via the Internet

HOW TO WRITE TO PC MAGAZINE

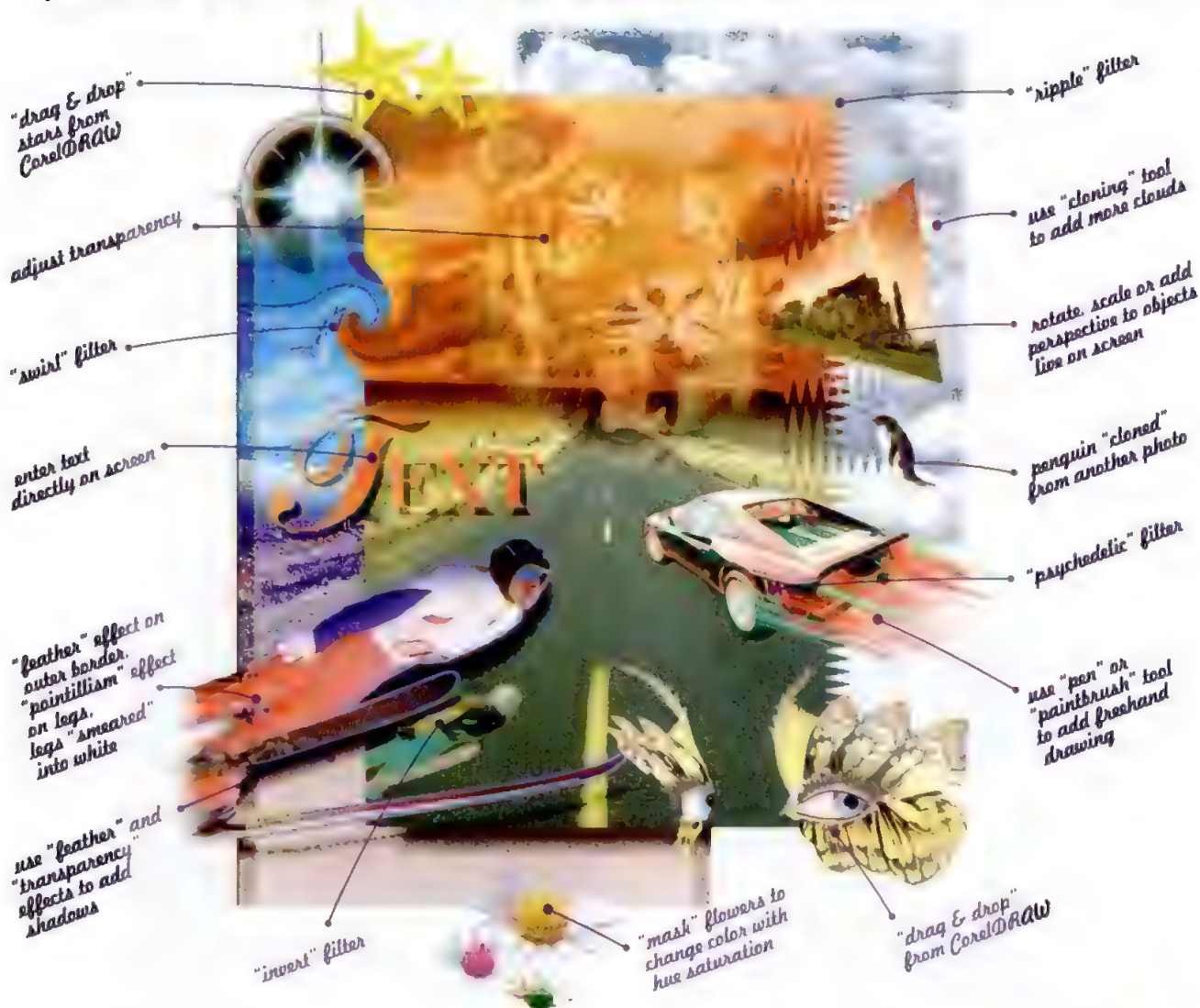
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Windows utilities for trouble-shooting and repairing the most challenging Windows problems. Such as uninstalling software. Or soothing INI nightmares. All while



Peter Norton delivers the only workstation security that won't send your administration costs rocketing out of control.

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It's safety and convenience. Which is reassuring when you're in that ever familiar panic mode.

PC World put it quite eloquently when they announced to the public, "Norton Utilities 8.0 is absolutely

SIDESTEPPING DISASTER IS A PRETTY NEAT TRICK. BUT WHO WOULD'VE THOUGHT THEY GRADED YOU ON IT?

teacher's pet. Other members of the press were equally complimentary. Statements surfaced like "the ultimate toolkit for DOS and Windows." And "Norton's new Windows Utilities can assure safer and more reliable computing than anything else on the market." Not something we would just come out and say about ourselves. But Byte and PC Magazine sure did.

"NORTON WORKS WONDERS."

More praise, courtesy of Windows Magazine. But it should come as no surprise. After all, Norton Utilities Version 7.0 was comprised of the best disk-repair and safety utilities on the market. And the critics deem version 8.0 even better.

"THE ULTIMATE TOOLKIT FOR DOS AND WINDOWS."

Like PC Computing Magazine said, Norton Utilities 8.0 works for both DOS and Windows. It has unique

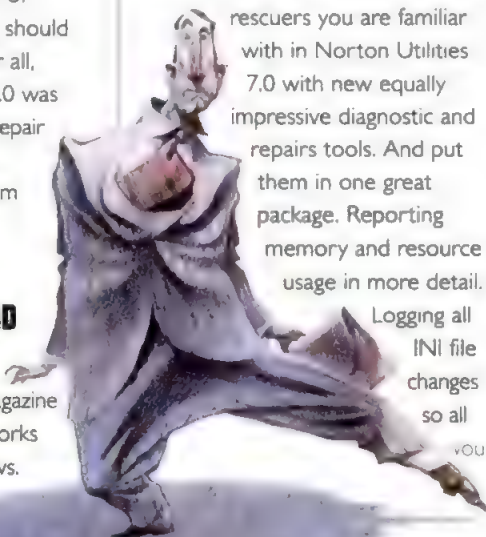
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Norton Utilities received a 9.4 out of 10 on its Desktop Utilities Report Card in the May 9, 1994 issue of InfoWorld.

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SYMANTEC.

Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

Pentium Notebooks

They won't melt in your lap!

You've heard the complaints for nearly a year: Pentium chips are too big and too hot to find a home in notebooks, and since they need a secondary cache to feed their voracious data appetites, it'll be a long time before you can buy a Pentium notebook. But thanks to some clever technological feats, notebook buyers will finally get the benefit of the Pentium's power this fall.

A member of the 3.3-volt P54C chip family, the newest Intel Pentium CPU is made expressly for notebooks. A 75-MHz version that can operate on a 50-MHz bus will ship this year. A 90-MHz version that has a 60-MHz data bus will be available in 1995.

Toshiba is the first mainstream player to design cutting-edge features into its notebooks to make the best use of these Pentium chips. To reduce heat and keep the size and weight of the units down, Toshiba's forthcoming Pentium notebook will use a paper-thin tab-automated bonded (TAB) version of the Pentium chip instead of the bulky ceramic pin-grid array (PGA), which encases the chip used in desktop systems. The smaller TAB package, which Toshiba claims runs cooler than the PGA version, bonds easily to the motherboard and doesn't need a noisy, bulky fan to keep it cool.

Toshiba's new notebook will also use an advanced form of DRAM called *extended-data-out* (EDO) DRAM in lieu of costly

external (Level 2) cache. Toshiba says EDO DRAM will provide performance comparable with that of a secondary cache. Since the L2 caches require cache controllers, extra space on the motherboard, and silicon for the cache, eliminating an L2 cache means

Toshiba can save engineering time and manufacturing dollars. Notebooks can also save on battery power, since the SRAM chips that normally make up an external cache's data repository are eliminated.

EDO DRAM, which is also known as hyper-page-mode (HPM) DRAM, replaces fast-page-mode (FPM) DRAM in the Toshiba notebook.

According to Bart Ladd, NEC's product marketing manager for DRAM, "Hyper-page mode keeps the window of availability of valid data open longer than FPM." The result is a significant speed improvement. "HPM will replace fast-page mode because it's 38 percent faster and will eventually only cost 5 percent more," says Ladd.—*Christopher Barr*

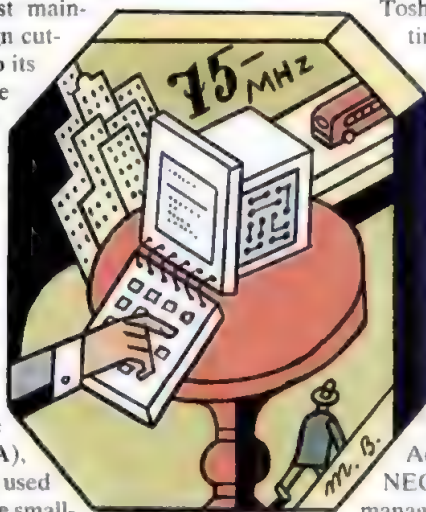
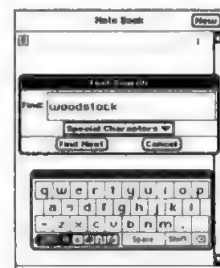


Illustration by Maris Bishofs

PDA's Under \$500

IF THE FIRST WAVE OF PDAS WERE toys for Baby Boomers, then PDAs for Generation X will soon be upon us. Tiny Geoworks burst upon the PC scene in 1990 with its Geos operating system, but it never caught on, even though it was technically praised. Now the company is readying another version of its core technology. Armed with cash from a recent initial public



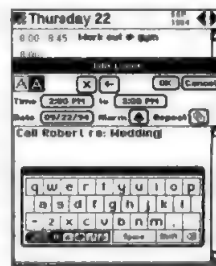
Geos reemerges on lower-cost PDAs.

offering and new partners, Geoworks is well positioned to supply Geos to a new generation of inexpensive PDAs the company calls *consumer computing devices* (CCDs).

By working closely with Hewlett-Packard, Novell, and Sharp Electronics, Geoworks has reworked and repositioned Geos as the operating system for communications devices priced under \$500. Written in assembly language, Geos 2.1 is smaller and faster than the version used in Casio's Zoomer, the first hand-held device to use Geos.

At a minimum, a CCD running Geos would contain an electronic organizer, a calendar, a datebook, a calculator, and maybe a pager and games. With the imminent release of a new content-development tool that creates hypertext-like links in published data, Geoworks chairman Brian Dougherty sees the day when CCDs could use infrared links to download programs such as city maps, restaurant guides, and airline schedules from kiosks.

Geoworks and its new partners are keeping mum about the details of forthcoming CCDs, but you can expect Geos to turn up in handheld, pen-operated organizers, as well as in smart cellular telephones.—*Christopher Barr*



A hand-held OS with all the accessories.

Pipeline By Robin Raskin

After the Thrill Is Gone

Don't get me wrong. I appreciate the sentiment of a good "Out-of-Box Experience." As a matter of fact, at *PC Magazine* we talk about it so much that I'm glad Acer finally coined the acronym OOB ("ooo-bee") to sum up that exhilarating feeling you get when you buy a PC/software bundle you can actually get going without resorting to bribing your computer-breathing friends to pitch in. But the OOB endorphin rush doesn't last a lifetime. It's time for software publishers to develop consumer products that can actually do some useful work once the thrill is gone.

Case in point. My 12-year-old daughter had to create a "reflection" about herself for the opening day of school. I suggested that it would be a great place to debut the prowess of our new HP DeskJet 500C. Whatever she reflected on, it had to include color, I thought. (Yes, I'll take the rap for putting product before process!)



"Great," she said, "I'll start with a quotation." At my suggestion, she spent more than an hour perusing the *Columbia Dictionary of Quotations* in Microsoft Bookshelf, which, when you finally get down to using it, has a pretty lame selection if you're 12 years old and looking for a definitive statement on youth.

Since quotes were a bust, she decided to make a map of her life. "This is me" would go in the center, surrounded by roadways to all her favorite activities: the chorus, the violin, and so

on—shown with pictures and brief text. It's a simple but elegant concept.

That's when the tools began to fail miserably. Microsoft Creative Writer made some beautiful word art filled with interesting shapes and patterns, but the clip art was pathetic, and the product couldn't import outside art. Besides that, with its bitmap roots, it couldn't draw a straight line. Creative Writer's counterpart product, Fine Artist, was similar—plenty of special effects but no clip art of a violin, no way to import, and no way to draw a decent straight line.

We briefly reverted back to our old favorite, KidPix, but the results looked decidedly juvenile. Crayola Amazing Art Studio, from Micrografx, is overwhelmingly delicious, with projects such as place mats and certificates, cool electronic felt-tip markers, paints and crayons that actually mix colors on-screen, text that can be placed vertically, and some 3-D shapes. But again, no clip art, no straight lines, and no pasting via Windows. Visio Home, a consumer product from Shapeware, made the most progress on the map part of the project with great connecting lines, but it had pitiful clip art and text and no panache whatsoever.

Two days later, my daughter was a confirmed Luddite. To add insult to injury, the cool-looking text she finally did with Creative Writer looked all muted and murky when printed on the DeskJet. Still, we took the text and used real live scissors to cut it into a map drawn with CorelDraw (duly noted that most homes won't have a package costing \$300 or more to fall back on). My daughter is still chewing my ear off about how the project could have been done in a few hours using markers, a ruler, and some paper. And you know what? I believe she has a point.

Robin Raskin is editor of PC Magazine.

On-Line Music: It's Got a Good Beat and You Can Download It

THE IDEA OF DISTRIBUTING popular music on-line got a huge boost this past June when thousands of fans rushed to download a new Aerosmith song from CompuServe despite the huge file sizes involved. The 3 minute, 14.3MB song took 1 hour to download with a 14.4-Kbps modem.

Now that the recording industry has plugged into the on-line world, you don't necessarily need to go to the record store or read magazines to learn about new bands like Sugar Tooth and Weezer.

"People like the idea of being able to dial in and get information about bands right from the record company," says Robert von Goeben, a graphic-arts manager at Geffen Records who orchestrates the record company's on-line persona. "I found that whenever I wanted information about computer software, I'd just go on-line to contact the company directly and get some information

before I went to the store. I started thinking that you could do the same with CDs—get sound samples and graphics of the band to get an idea whether this was music you'd really like."

The entire music industry—classical, jazz, rock, and so on—is experimenting with on-line services as a way to distribute information to consumers. Arista Records, PolyGram, Virgin Records, Warner Brothers, and independent labels have opened sections on CompuServe's Recording Industry forum to provide fans and prospective fans with music samples, tour schedules, .GIF photos, and release dates; sysops stand by to answer questions.

It doesn't end there. PolyGram recently held an on-line audition for prospective drummers for the band Cinderella. Geffen has recently opened an Internet site to reach more college students, and elsewhere on the Internet you can find more than 50 news-

groups devoted to musicians spanning the spectrum from Amy Grant to Danzig. Independent musicians looking for exposure even have their own Internet sites—such as City of Tribes at <http://www.organic.com> and the Internet Underground Music Archive—from which they distribute audio and video clips, band photos, discographies, and liner notes.

"It's a great vehicle for new artists and a great way for word of mouth to spread," says Andrew Rauhauser, director of planning at PolyGram. Whether we're actually going to buy music this way is another question. Says von Goeben, "I think we're a long way from that."—Carol Levin and Don Willmott

TRENDS PLUS

To get an idea of what on-line distribution of music is all about, visit PC MagNet's Editorial Forum on ZiffNet to download "Lite Up," a song by the New York-based band Genetica. Type GO EDITOR from any CompuServe ! prompt and look in the Trends library. If you're on the Internet, you can get this file and samples from major record labels by visiting our World-Wide Web page at <http://pcmag.ziff.com/~pcmag/pcmag.htm>. Or you can FTP the files from PC Magazine's FTP server at <ftp://pcmag.ziff.com>.

Color Printing Gets Cheaper

ONE BUYING DECISION YOU WON'T have to make again is whether your next printer will be color or monochrome. That's because printer manufacturers have already made the decision for you.

Hewlett-Packard recently replaced its monochrome-only ink jet with a color-capable ink jet that's expected to sell for a street price of under \$300, including the \$49 color upgrade kit (a snap-in three-color cartridge and storage container). The HP DeskJet 540 can't use color and black inks at the same time, so you'll need to snap in the black cartridge for monochrome printing. Canon, Digital, Epson, Lexmark, Olivetti, and Texas Instruments are also offering more affordable color ink jets.

The shift from monochrome to color is really picking up steam as the price difference between the two narrows. Says John Goetz, senior industry analyst at Dataquest, "Today the low-end of the color ink jet market is in the \$380 to \$400 range. By early 1995, this entry point should be

around \$299 to \$325. By the end of 1995, it could easily cross \$250."

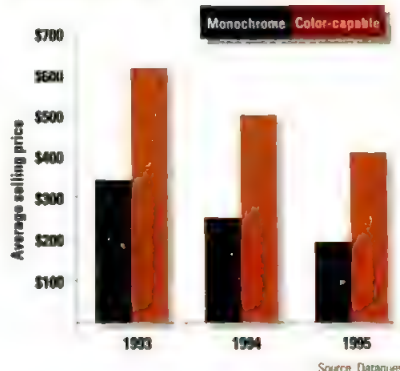
Meanwhile, the price of color lasers is falling as well. Last year, you had to shell out \$10,000; this year, around \$6,000. (We evaluate three color laser printers in next issue's printer blockbuster.)

What's driving the shift to color? As the ten-year-old ink jet technology has matured, manufacturers have come up with ways to reduce manufacturing costs, improve technology, and reduce prices. Also, the drop in PC prices has some effect on printer and peripheral prices. This year, HP expects sales of color ink jets to surpass sales of monochrome printers.

A cautionary note: While you'll pay less for color at the outset, the cost of owning a color printer is greater than that of a monochrome printer because color printers guzzle expensive ink cartridges. (Per-page costs are from 3 to 9 cents for monochrome, but from 15 cents to 1 dollar for color, depending on coverage.) "At first, buyers are concerned with price and quality, but once

Ink Jets: A Better Deal

Driven by the rapidly growing home market, ink jet printers are coming down in price, and the market for color ink jets is expected to quadruple by 1997.



they're using the printer, speed and cost of consumables are more important," says Goetz. As color capability becomes more common, though, the cost of consumables will drop as well.—Carol Levin

Is It Real or Is It WaveFront?

A RECENT TECHNOLOGY TO emerge from Intel Architecture Labs, the Oregon-based R&D arm of Intel, promises to make high-quality PC audio available at a low cost.

Thanks to advanced music synthesis technologies, sound quality on the PC has improved, but it has also become more expensive. Today, the best possible sound your PC can produce is generated by *wavetable synthesis*, a technique that produces realistic-sounding music by using the actual recordings of real instruments that are stored on ROM. (The term comes from the table of waveforms that store specific sounds.)

"The movement toward wavetable synthesis hasn't taken off because the technology adds even more hardware to the sound card," says Eileen Carlson, product manager for audio codecs at Integrated Circuit Systems in Valley Forge, Pennsylvania. In fact, it requires a chip set with a minimum of two parts—the wavetable synthesizer and the ROM where the sound is stored. Prohibitive cost is one reason why sound-card developers continue to use FM synthesis, an inexpensive technique that simulates—rather unimpressively—the sounds of different instruments by combining synthesized sounds.

To bring the cost down, Intel has devel-

oped WaveFront VS, a software-based algorithm that uses the PC's CPU as the synthesizer and the PC's main memory to store recordings of instruments. Apart from using the PC's existing audio codec (the core of all sound cards), WaveFront does not need any hardware. The idea of relying on the CPU for such peripheral activities as producing sound is known as *host-based processing*.

"WaveFront VS eliminates the final barrier to better-quality sound and music on the PC," says Carlson. Compared with \$20 to \$30 for hardware-based wavetable synthesis, WaveFront VS costs around \$4. ICS has licensed the WaveFront algorithm from Intel.

With the CPU doing extra work, how much of a hit does the system take? According to ICS, a 486/25 system with four applications running takes a 20 percent hit. A Pentium-based system takes a 7 percent hit.

Later this fall, AMP and Turtle Beach (a subsidiary of ICS) plan to introduce Audio Advantage, the first sound card to offer software-based wavetable synthesis. The long-term objective, says Carlson, is to sell the algorithm as a commercial product and let consumers upgrade their own sound cards by installing floppy disks. ICS is now tackling another big project: to adapt the WaveFront VS algorithm for different audio codecs on the market.—Carol Levin

Top Retail Software

Current ranking	Last issue	Product/company
1	1	MS-DOS 6.22 Upgrade Microsoft Corp.
2	4	Procomm Plus for Windows 2.0 Datastorm
3	—	WordPerfect 6.0a for DOS WordPerfect, The Novell Applications Group
4	3	MS Windows 3.11 Microsoft Corp.
5	—	MS Access for Windows 2.0 Upgrade Microsoft Corp.
6	—	MS Office 4.2 for Windows Microsoft Corp.
7	—	MS Excel 5.0 for Windows Microsoft Corp.
8	10	WinFax PRO 4.0 Delrina Corp.
9	—	Lotus SmartSuite 3.0 for Windows Lotus Development Corp.
10	2	CorelFLOW 2.0 Corel Corp.

This list ranks PC business programs according to the total number of copies shipped to over 12,000 stores and resellers in the week ending September 3, 1994; the list cannot be interpreted as a picture of the entire software market. Adapted from a compilation by Ingram Micro.

Generation X Ray

Experimental chip-making techniques will pay off in the next decade.

THE REASON PCS KEEP GETTING more powerful and cheaper is because more transistors can fit on a single chip. But given the limitations of today's chip-manufacturing technology, how will chip makers keep up the frantic pace of progress?

A synchrotron would help. Only a handful exist, and they cost \$25 million each. Semiconductor companies need access to one of these X-ray-generating machines to develop an experimental chip-manufacturing technology called *X-ray microlithography*. Scientists at AT&T, IBM, Loral Federal Systems, and Motorola plan to work together to make this promising yet economically risky technology commercially viable by the start of the next century. The objective is simple: to pack more transistors onto a chip.

"We see X-ray [microlithography] as being the next generation of lithographic tools required to do advanced semiconductors," says Steve Schnur, program manager of microlithographic mask development, an ARPA-sponsored project at Loral Federal Systems (formerly IBM Federal Systems) in Manassas, Virginia.

Today's optical lithography uses ultraviolet light to expose a thin coating of light-sensitive chemical on a silicon wafer, much like a film exposed to light produces an image on a negative or transparency. By positioning a *mask* containing the pattern of the transistors and connection lines above the silicon, only the tiny lines are exposed. Once this miniature "stencil" of the circuitry is formed on the chip's surface, the lines are then etched onto the silicon.

The problem is that the physical properties of the light determine the size of the lines, and the size of the lines determines the size of the transistors. The more powerful the chip.

Light plays a fundamental role in the manufacturing of chips, and researchers have been conducting experiments since the 1970s with light of different wavelengths. The short wavelengths of X rays

(200 times smaller than deep ultraviolet light) go a long way toward making denser chips because the precise X rays are able to imprint incredibly tiny lines onto silicon wafers—some as small as 0.18 microns wide. A Pentium chip is based on a 0.5-

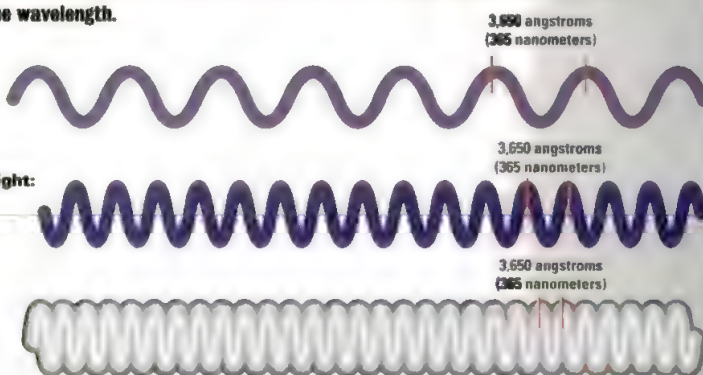
Shorter Wavelengths, Smarter Chips

Unlike ultraviolet or even deep ultraviolet light, X rays can etch smaller, more precise components onto silicon wafers. The energy of the particles that make up the light (photons) is inversely proportional to the wavelength.

Ultraviolet light:
Used to make chips based on 0.5-micron design rule.

Deep ultraviolet light:
Used to make chips based on 0.35-micron design rule.

X-ray:
Used to make chips based on 0.18-micron design rule.



Note: * 1 nanometer is 1/1000 the width of a human hair. This representation is not drawn to scale.

micron design rule; one hundred microns are about as thick as one human hair.

So why is optical lithography still going strong and expected to drive the next few generations of chips? "Nothing will replace established lithography until there's a very good reason. Either optical will no longer be capable of delivering what's needed, or the cost of the new technology will be lower,"

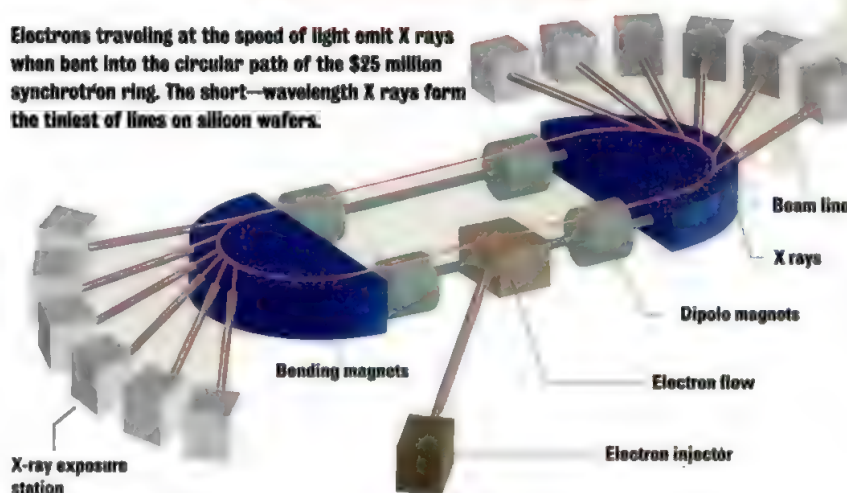
says George Celler, a scientist at AT&T Bell Laboratories' advanced lithography research department.

Bell Labs is working on an alternative to the synchrotron, called a *point source* X-ray generator, in which a small plasma plume emits a high-energy laser burst that vaporizes small amounts of iron and generates X rays in 10-nanosecond pulses. Several such pulses would provide enough X rays to expose silicon; moreover, the generator is much cheaper than a synchrotron.

The cost of the synchrotron aside, there are other technical details that need attention. The biggest hurdles are in the mask technology. "X rays tend to be absorbed by all materials, so we're forced to go to a thin membrane of light atomic weight, such as silicon nitride or silicon carbide," says Joe Mogab, manager of advanced processor development at Motorola.

Synchrotron Ring

Electrons traveling at the speed of light emit X rays when bent into the circular path of the \$25 million synchrotron ring. The short-wavelength X rays form the tiniest of lines on silicon wafers.



"The first potential window of opportunity for X-ray microlithography is the 0.25-micron, 256-Mb DRAM chips," says Bell Labs' Celler. "Volume production is expected in 1998." If everything falls into place, the next step will take place in about 2001, when the 0.18-micron, 1-gigabit DRAM chip will be produced.—Carol Levin

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Pentium-90	\$3095

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- ▶ Diamond Stealth 64/PCI local bus SVGA color graphics card with 2MB VRAM
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- ▶ 101-key space-saving keyboard
- ▶ Microsoft DOS 6.2 with Enhanced Tools, Windows for Workgroups 3.11, choice of Lotus Windows application



BEST & Experts' Pick ZEOS Multimedia PC

Pentium-60	\$3388
Pentium-66	\$3538
Pentium-90	\$3638

The above PC modified to include:

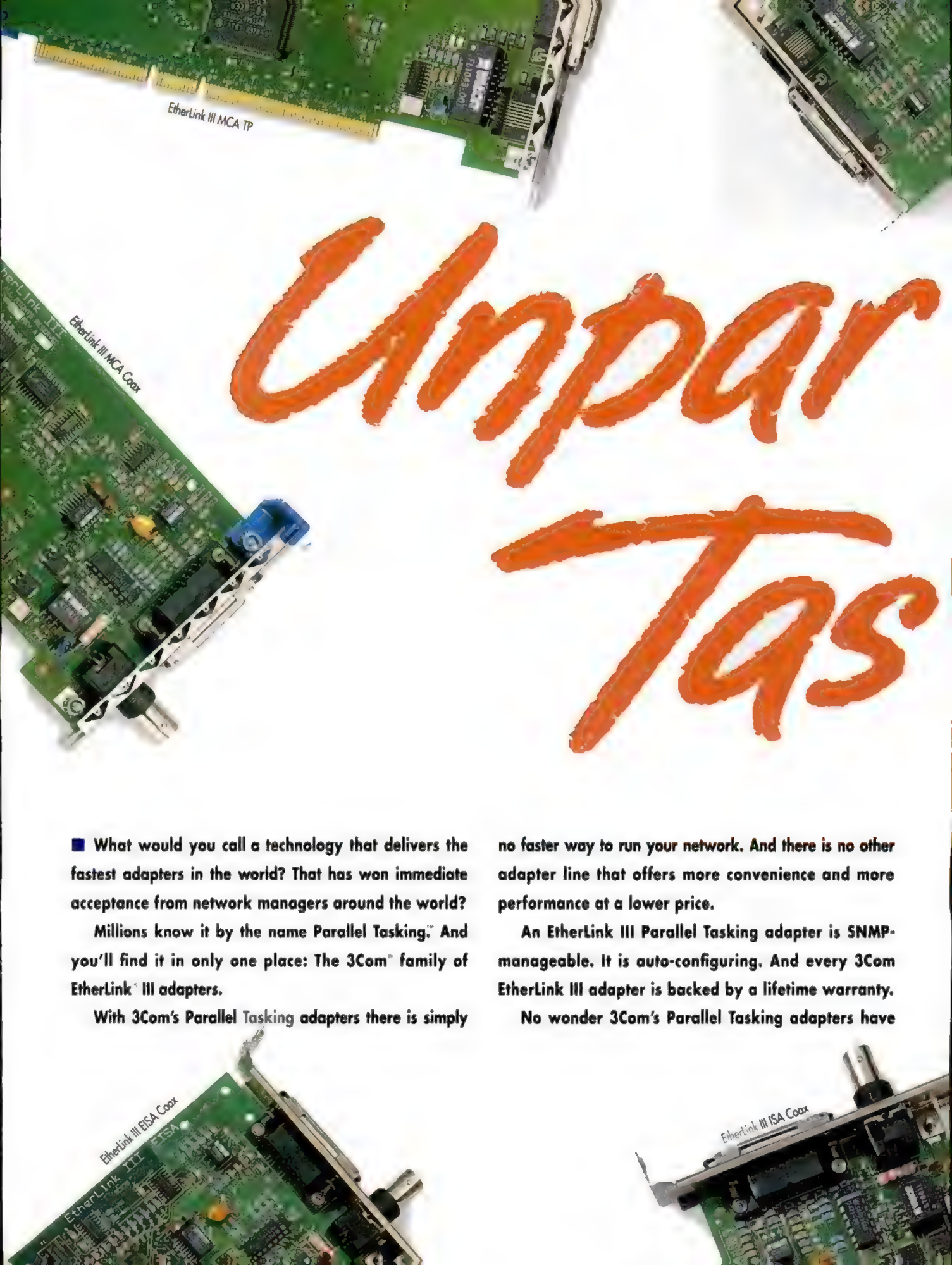
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CIRCLE 920 ON READER SERVICE CARD

First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Windows Utilities

Keep Windows Healthy with These Six Problem Solvers

BY J.W. OLSEN

Using Microsoft Windows can be a double-edged sword: It shields you from some problems but it also introduces challenges of its own. At the same time, Windows doesn't help much with interrupt conflicts and fine-tuning overall system performance.

With the replacement for the present generation of Windows coming soon, these utilities—some newcomers, some improved—are intended as a Windows maintenance and repair kit.

TOUCHSTONE WINCHECKIT
TouchStone Software's \$79.95 WINCheckIt 2.0 is a compre-



CHECK IT, FIND IT: WINCheckIt's Reference Library almost makes tracking down related technical help fun.

hensive product that analyzes system performance, tests hardware reliability, and troubleshoots diverse problems. WIN-

CheckIt optimizes Windows memory in order to increase the size of the largest available memory block, removes duplicate files and empty files, tracks system changes, and helps uninstall applications. An editor modifies essential system files or restores previous versions

that have been modified by subsequent software or hardware installations. Another feature creates a rescue disk of key files

and CMOS settings.

A Reference Library makes looking up technical tips fun, while WINCheckIt's Software Shopper module helps pinpoint required system resources when adding peripherals. WINCheckIt includes Set Up Advisor (which is reviewed separately).

The beauty of the WINCheckIt utility is the different levels of detail that it affords: from relatively benign default mode all the way through aggressive advanced modes. But there are some problems that WINCheckIt missed: On one test system, default mode incorrectly determined available video RAM and the display color setting and overlooked an on-line fax modem; on another, the system hung completely on anything beyond default mode.

These weaknesses aside, overall WINCheckIt offers a lot for your dollar.

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■ PCs

Tangent and NexGen Team Up to Challenge Intel

BY WILLIAM P. FLANAGAN

From the exterior, the \$2,699 Tangent Nx5 P90, from Tangent Computer and NexGen, looks like any other high-performance PC. What makes it revolutionary is the NexGen processor that powers it. The NexGen Nx586 chip is not just the first to offer the power and speed of a RISC CPU for x86-based applications: It's also the first affordable alternative to Intel Corp.'s Pentium that does not involve sacrificing performance. The joint effort is likely to have a mixed reception:

For mainstream PC users, the Tangent/NexGen alliance will seem like a needed breath of fresh air, but high-end users may regret the system's lack of a coprocessor.

On the surface and, for the most part, internally, the Nx5 P90 is not a radical departure from traditional desktop computing. The system can run any DOS or Windows application available today. Storage and expansion consist of six drive bays: three internal 3.5-inch and three accessible 5.25-inch bays. The Alaris motherboard has



NEXT CHIP: The Tangent Nx5 P90 is built around the NexGen 586 P90 processor, giving it full Windows compatibility and performance on a par with a 90-MHz Pentium.

seven ISA slots, two with VL-Bus connections.

With its Nx586 processor,

Continues on page 40

First Looks

Windows Utilities

CONTINUED FROM PAGE 37

TOUCHSTONE CHECKIT SET UP ADVISOR

The \$29.95 CheckIt Set Up Advisor, Version 1.1, seeks to be a precursor of the Plug and Play functionality promised in the next version of Windows. Set Up Advisor documents your current configuration, along with existing conflicts, and identifies available resources. It also provides look-up requirements for add-on peripherals and recommends specific resource assignments. Even pros will find Set Up Advisor valuable for determining IRQs, DMA channels, I/O ports, and memory addresses when installing devices.

Commendably, in analyzing your system Set Up Advisor considers overall information to form conclusions rather than simply considering each device independently. If your current utilities lack peripheral configuration help, Set Up Advisor is a great single-purpose product for a minimal cost.

LANDMARK WINPROBE

Landmark Research International's recognized expertise in diagnostics is evident in its \$99 Landmark WINProbe, Version 3.0. WINProbe troubleshoots hardware and configuration problems, optimizes Windows, and provides technical information.

Analysis and optimization are provided for SMARTDrive fragmented Windows memory, Windows resources, and Program Manager groups. Among the tests that the system

tests for COM ports and modem control lines, disk drives, and printer operation. WINProbe also helps with peripheral installation and CMOS settings, clean-up of .INI and .GRP files, memory management, and conflicts involving IRQ, DMA, and I/O base addresses. A real-time status panel displays diverse statistics, and a tear-off panel floats on top of your desktop. A simple .INI file editor is provided, as well.

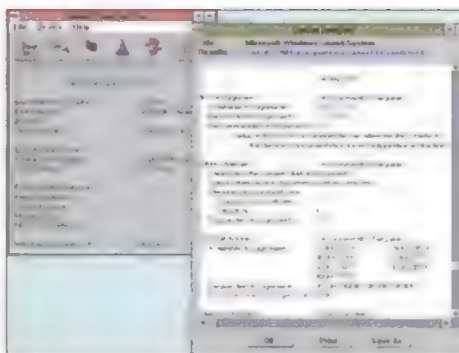
Version 3.0 improvements include expanded optimizing tips; diagnostics for CD-ROM, PCMCIA, and sound cards; and automated Windows memory defragmentation and resource optimization at definable intervals that release resources that are no longer used. WINProbe's resource detection is good but not perfect: A 386SX CPU was detected as a 386DX, a second COM port wasn't recognized on a test system, and while the status panel continued to update and you could switch to other applications, WINProbe sometimes failed to give control to the user in its own window.

But overall, if you want it all in one comprehensive package, WINProbe delivers.

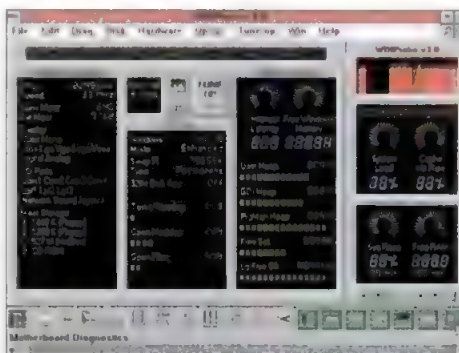
LANDMARK DATASAFE

Landmark Research International's \$99 Landmark DataSafe lurks in the background, riding to your rescue when Windows' own fault handler is triggered.

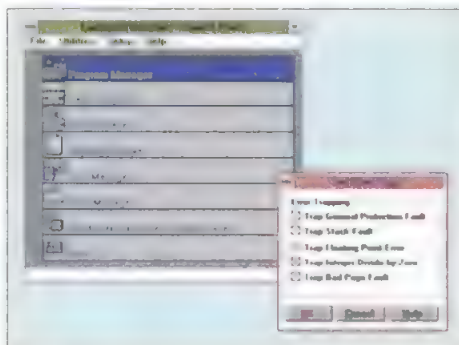
Above all, Windows wants to survive. During a major fault you often have little choice but to close an application (or Windows itself) and lose unsaved data. DataSafe emerges to issue a warning and a chance to save your data. You can trap up to five types of errors: General



ADD-ON: When you add a new device, Set Up Advisor checks for compatibility with your current system and makes recommendations.



MONITOR: WinProbe finds and displays an impressive array of system statistics.



WIDE NET: DataSafe lets you specify the types of error conditions it traps.

Protection Faults, stack and bad-page faults, and floating-point math and integer divide-by-zero errors. The log saves an impressive array of details. For example, a divide-by-zero error yielded more than 300 lines of organized information and recommendations. The log is flexible and can include copies of critical system files.

Even if your lucky rabbit's foot usually saves you from general protection faults and you won't be using DataSafe on an

ongoing basis, you should keep this utility handy for future applications that are not so benign.

CYBERMEDIA FIRST AID

At \$129.95, CyberMedia's First Aid for Windows users, Version 1.2, is the most costly product in this group of Windows cleaners. First Aid runs either in the background to solve problems or as a user-executed tool. Among the problems that are addressed by First Aid are peripheral conflicts, invalid WIN.INI and SYSTEM.INI entries, misplaced drivers and .DLLs, incorrect path or parameter settings, OLE registration errors, and network printing for NetWare 3.0 and Windows for WorkGroups 3.11. Encountered problems are logged and can be printed, and an Undo feature is available for use after an unsuccessful attempt to solve a problem.

Much of First Aid's magic relies upon its knowledge of specific applications; 17 applications are supported. (Cybermedia promises more in the future). A technical tips module commendably moves beyond help for Windows itself and specific

applications to address problems involving a combination of applications.

First Aid's dual persona as silent watchdog and user-executable safety net, as well as its application-specific and cross-application approach are promising. But at \$130, we would prefer that more applications were supported.

NEOCOM WINFORMANT

Neocom Microspecialists' \$49.95 Winformant, Version 2.0,

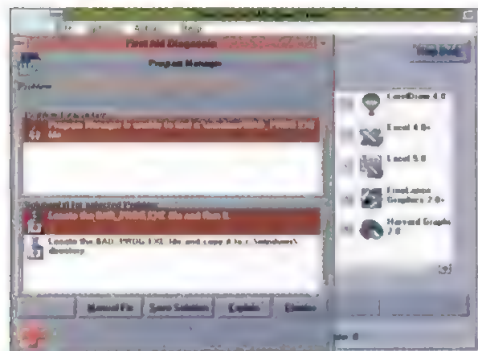


From October 24 to 28, you can go on-line to discuss Windows utilities with reviewer J.W. Olsen and product executives from the companies included in this review. Type GO EXEC at any CompuServe! prompt.

First Looks

is a shot of preventive medicine. If you don't have a broad set of utilities, wInformant provides a great mix in one package. You will immediately appreciate its speed and relative simplicity without the cluttered, ancillary

tually all related resources: .INI files, lines in system .INIs, icons, Windows groups, subdirectories—even OLE objects. It even works for applications that were installed before wInformant. The .INI editor is simple but well



REPAIR: First Aid proposes solutions to many different problems as they occur.

features found in many alternatives.

Unlike lesser uninstall programs, wInformant identifies and purges applications and vir-

Windows' Notepad. Finally, one mouse click exits and restarts Windows.

You'll appreciate an always-on-top feature and quickly

become addicted to wInformant's speed and solid functionality.

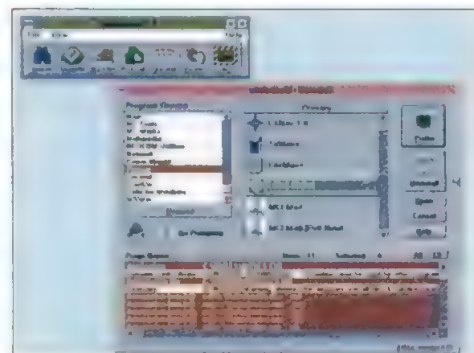
MIX AND MATCH

The feature set of products in this roundup overlap, but each also offers unique functionality. Best bet? Consider your personal needs, then determine which products fit best.

Chances are that a combination of them belong on your hard disk.

► **WINCheckIt, Version 2.0.** List price: \$79.95. Requires: 2MB RAM, 2.5MB hard disk space, Microsoft Windows 3.1 or later. TouchStone Software Corp., Huntington Beach, California; 800-531-0450, 714-969-7746; fax, 714-960-1886.

Circle 426 on reader service card



PURGE: wInformant's Uninstall function determines files, directories, and .INI file entries associated with a file.

► **Chec-It Set Up Advisor, Version 1.1.** List price: \$29.95. Requires: 2MB RAM, Microsoft Windows 3.1 or later. TouchStone Software Corp., Huntington Beach, California; 800-531-0450, 714-969-7746; fax, 714-960-1886.

Circle 427 on reader service card

► **Landmark WINProbe, Version 3.0.** List price: \$99. Requires: 1MB RAM, 1.5MB hard disk space, Microsoft Windows 3.x. Landmark Research International Corp., Clearwater, Florida; 800-683-6696, 813-443-1331; fax, 813-443-6603.

Circle 428 on reader service card

► **Landmark DataSafe.** List price: \$99. Requires: 640KB RAM, Microsoft Windows 3.1 or later. Landmark Research International Corp., Clearwater, Florida; 800-683-6696, 813-443-1331; fax, 813-443-6603.

Circle 429 on reader service card

► **First Aid, for Windows users 1.2.** List price: \$129.95. Requires: 4MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later. CyberMedia Inc., Los Angeles, California; 800-766-8861, 310-843-0800; fax, 310-843-0120.

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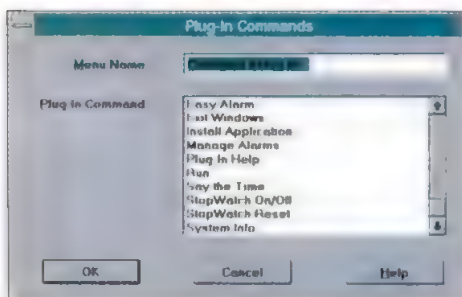
► **wInformant, 2.0.** List price: \$49.95. Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1 or later. Neocom Microspecialists Inc., Martinsville, Virginia; 703-666-9533; fax, 703-666-9534.

Circle 431 on reader service

■ Pull-Out Program Manager and Plug-In 2.0

Plannet Crafter's Plug-In for Windows, Version 2.0, is the shareware approach to adding functionality to many parts of Windows. Overall, the \$20 Plug-In keeps better track of system resources than Windows and warns when you're near the limit.

What is most exciting about Plug-In is how it treats memory. The program reports information on the total memory and the nondiscardable memory taken by each of your windows programs and utilities. When Plug-In is loaded, you can display free resources in the ProgMan icon, and set an alarm to go off when the level of free resources falls below a specified limit.



TIME: In addition to launching programs, the Quick Launch menu can display a stop-watch command or talking clock.

Plug-In also lets your closed ProgMan groups display an icon of your choice, and adds two features for quick launch: the right button on a closed ProgMan group displays a list of group items, and the right button on the desktop brings up a launch menu. If you have an application running full screen, this launch menu is also available by hitting the right mouse button on the active program's control menu button.

For those who periodically need a reminder, Plug-In lets you set timed alarms. There is also a chiming clock, as well as a talking clock that speaks the time; you can set the chiming clock to

be activated during certain hours. Plug-In includes a sound event module that lets you assign .WAV or MIDI sounds to actions, such as the closing of an application.

The modules have an intelligent, considerate design throughout, and at \$20, Plug-In is a great bargain and an attractive utility collection for any Windows user.—Barry Simon

Plug-In for Windows, Version 2.0. List price: \$20. Requires: 2MB RAM, 1.5MB hard disk space, Microsoft Windows 3.1 or later. Plannet Crafters Inc., Alpharetta, Georgia; 404-998-8664; fax, 404-998-8179.

Circle 432 on reader service card.

NexGen/Tangent

CONTINUED FROM PAGE 37

NexGen is the only competitor of Intel to offer a fifth-generation PC processor. The Nx586 runs at 4volts and uses RISC principles. NexGen calls its approach RISC86 architecture (see the sidebar "A Look Inside the NexGen 586"). Because of the space required for the translation from RISC86 to x86, the NexGen CPU relegates the math coprocessor to an external option. Most users will not even notice the lack of floating-point operations, but the feature may be sorely missed by power users.

The Tangent Nx5 P90 system we tested came configured with an Nx586 P90 processor, 16MB of system memory, and a 256K cache. Contrary to the system's nomenclature, the processor runs at 84 MHz, not 90 MHz. The name is derived from the company's desire to compete with Intel's 90-MHz Pentium processor. The Tangent's disk and video subsystems were based respectively on a 540MB Conner hard disk and the Diamond Stealth VLB card with the Vision 964 chip set. The system contained a double-speed CD-ROM drive and a 15-inch monitor.

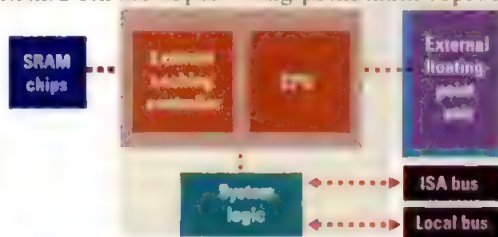
On the whole, the system was competitive on our benchmark tests with the average of 90-MHz Pentium systems tested by PC Labs—with one exception. The system's processor score, was low due to the design of our benchmark tests rather than any fault in the NexGen processor or the system. On our Winstone test—the true measure of overall system performance—the system scored very close to the 90-MHz-Pentium average.

In terms of compatibility with DOS and Windows applications, we could find no problems. For all

■ A Look Inside the NexGen Nx586 Processor

From the start, the goal of the NexGen Nx586 processor was to produce a reduced instruction-set computing (RISC) alternative to Intel's Pentium. To be compatible with the library of 50,000 PC applications, the chip had to mimic x86 instructions. By taking advantage of the efficiency of RISC techniques and streamlining the data flow through the processor, the NexGen's RISC86 microarchitecture is able to outperform the Pentium, megahertz for megahertz.

While not a clone, the Nx586 has a lot in common with the Pentium. Both use super-



DIRECT CONNECTION: NexGen's processor uses a CPU-based, external caching controller to make a direct connection with SRAM chips.

scalar designs with two execution integer pipelines; each chip is built using a 0.5-micron CMOS (complementary metal-oxide semiconductor) process, and each has roughly the same die size. But the Nx586 does the Pentium one better by executing RISC86 instructions, rather than the longer and more complex x86 instruction set. The key to the chip's compatibility is the circuitry needed to translate the RISC instructions. The translation hardware, contained in the processor's Decoder/Scheduler, occupies between 10 and 15 percent of the chip's active area.

To boost performance further, the Nx586 has twice the internal cache of the Pentium—16K of data and 16K of instruction cache—and the chip's design treats external cache in a unique way. With the cache controller on the chip, the Nx586 connects directly to the cache's SRAM chips via a dedicated 64-bit bus (see the

diagram). Rather than relying on the system I/O bus like the Pentium design, which is subject to bus traffic from other components, the Nx586 design always has the external cache's contents ready for use. In addition, the CPU uses inexpensive asynchronous SRAM chips for external cache. Two external cache sizes are available; 256K and 1MB.

High performance comes at a cost. The downside of this advanced design is that the extra hardware takes up a lot of space. As a result, the Nx586 relegates the system's floating-point math coprocessor to an external

option. In view of the fact that very few mainstream applications use floating-point instructions, the lack of the floating-point coprocessor will go unnoticed by many users. They are sure to notice

the system's reduced cost. In lots of 10,000, the 84-MHz Nx586 sells for about 20 percent less than a Pentium with comparable performance.

NexGen is not resting on its technological laurels. Over the next couple of years, NexGen will offer processors with faster clock speeds, a version that supports the PCI local bus, and a new design that will yield a chip die 30 percent smaller than the present one. Eventually NexGen designers plan to increase the number of independent pipelines to boost throughput. All this promises even more power for less money, continuing to challenge Intel on a chip-by-chip basis.—Brian Nadel

intents and purposes, the NexGen processor, which bears the Microsoft Windows compatibility seal, operated as if it were a true x86 CPU from AMD,

Cyrix, or Intel.

With a price tag of \$2,699, the Tangent system will give Intel a run for the money by helping to make high-end per-

formance affordable.

► **Tangent Nx5 P90.** List price: With 84-MHz NexGen Nx586 P90 CPU, 16MB RAM, 540MB Conner hard disk, Diamond

Stealth VLB video card, 15-inch monitor, mouse, DOS 6.21, Microsoft Windows 3.11, \$2,699. Tangent Computer Inc., Burlingame, California; 800-800-5550, 415-342-9388; fax, 415-342-9380.

Circle 433 on reader service card.

Benchmark Tests: Tangent Nx5 P90

The only high-performance Windows PC not built around a Pentium processor, the Tangent Nx5 P90 is a unique personal computer. Running at 84 MHz, its NexGen processor was powerful enough to keep the system's test scores close to the average marks posted by 90-MHz Pentium PCs. Higher scores represent better performance

	Winstone (Score)	Graphics Winmark (Millions of pixels per second)	Disk Winmark (Score)	Demomark (Score)	Processor (Score)	DOS Video (Score)	DOS Disk (Score)
Tangent Nx5 P90	100.5	35.5	2,340	1,053	78.0	3,248	1,895
90-MHz Pentium average	98.9	30.9	2,188	1,100	99.2	3,058	1,787

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The 45-page review for *Software Digest* covered all the bases. It was the most extensive review ever done on remote control software. In the end, the experts called ReachOut Remote Control simply "the best program in the...evaluation." It outscored the competition in not one, not two or three, but in seven categories. In its report for *Software Digest's* June '94 issue, National Software Testing Laboratories wrote:

NSTL recommends ReachOut Remote Control for its excellence in almost every category. No other program matches its number of features or ease of use, and it is the unanimous choice for best program in the testers' general usability evaluation.

The recommendation confirms the findings of exhaustive corporate evaluations. And it parallels assessments by such leading publications as *Byte*, *LAN Magazine*, *PC User*, *Network Computing*, *Government Computer News* and *InfoWorld*.

But why not judge for yourself? We will be happy to send you more information on the NSTL report. Better yet, take advantage of our 60-day money-back guarantee and order your copy of ReachOut today. Call 1-800-677-6232 for your nearest dealer location.

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THE MOST COMPREHENSIVE REVIEW OF REMOTE CONTROL SOFTWARE

SOFTWARE DIGEST RATING	OVERALL EVALUATION	PROGRAM
★★★★	8.5	Reachout Remote Control
★★★	7.5	Close-Up
★★★	7.3	Norton pcANYWHERE 1.0 for Windows
★★★	7.3	Carbon Copy for Windows

Voice Recognition

DragonDictate Listens

BY DAVID HASKIN

DragonDictate for Windows, Version 1.0, is the newest of the small but growing number of voice-recognition products for dictating directly into Windows applications. While it won't replace the keyboard and has a steep learning curve, the \$695 DragonDictate has the potential to be an innovative and accurate way to use your voice as an input device.

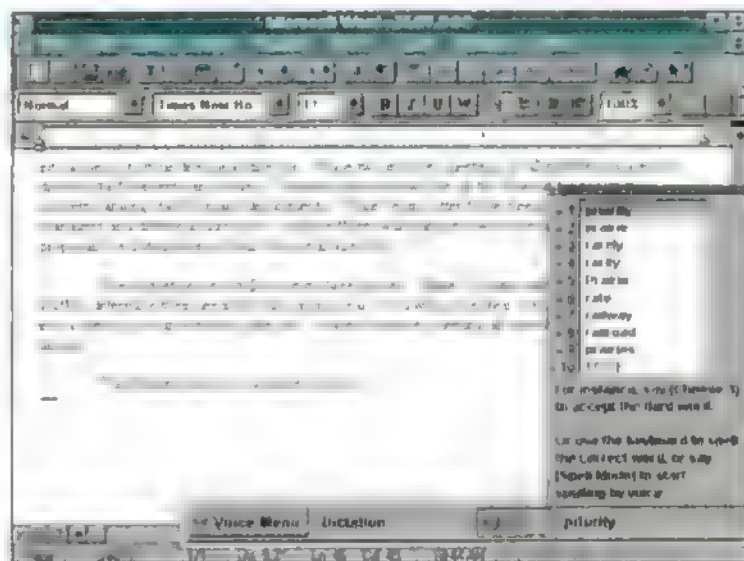
Like other dictation voice-recognition products, DragonDictate requires discrete speech, which means that you must pause between words. However, it doesn't take long to get used to this staccato speech style. And like other voice-recognition products, DragonDictate needs to learn your speech patterns, so it isn't very accurate at first. When we loaded it, we spent about 15 minutes training it for our voice; DragonDictate correctly recognized about two-thirds of our spoken words at first.

LEARNS TO LISTEN

The good news is that DragonDictate's accuracy improves as it learns your voice. After about 4 hours, DragonDictate selected the correct word about 80 percent of the time, which is on a par with other Windows voice-dictation products, such as Kurzweil Voice.

For each word you speak, a choice window appears with as many as ten sound-alike words. If DragonDictate places the wrong word in your document and the correct word appears in the choice window—for example, as the third alternative—you simply say "choose three to insert." You also can say "scratch that" to delete the previous word, and

give DragonDictate a second chance by repeating the misidentified word. Unfortunately, this procedure doesn't help DragonDictate learn. If the word you want isn't in the choice window, you can either spell it using the "alpha, bravo, charlie" voice-



CHOOSE: During dictation, a word-choice box appears listing nine alternatives.

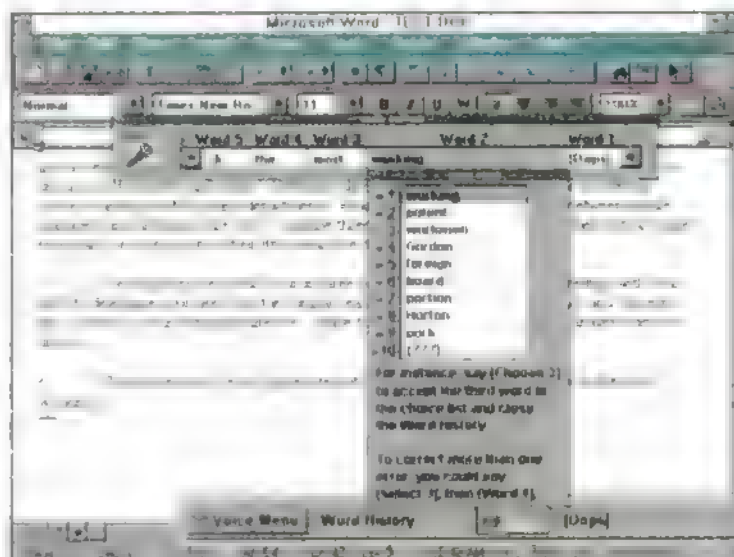
alphabet or use the keyboard.

Because of its adaptive learning, it took hours before DragonDictate became dependable as an input device. After that time, however, we accurately dictated at slightly more than 40 words per minute—somewhat better than an average typist and the equal of Kurzweil Voice (and at comparable accuracy).

DragonDictate has two separate modes: one for dictation and one for issuing commands to navigate within Windows applications. You can switch between modes with a verbal command. While it is initially easy to forget which mode you are in, there are advantages to this approach. When you are in command mode, DragonDictate can activate menus without special macros. For example, when in command mode, DragonDictate knows to open the Edit menu when you say "edit" and not insert that

word into the document, as it would have in dictation mode. This means that you can use DragonDictate to control any Windows program without touching a keyboard. In contrast, Kurzweil Voice requires special vocabularies for each application.

Since using menus isn't always efficient, DragonDictate also comes with vocabularies for 15 popular Windows applications. Unfortunately, DragonDictate includes very few voice macros, so you'll wind up adding new voice macros as needed. First, you speak the words for the command, then type the name of the command in the choice window and press Enter. A keystroke editor appears in which you type the keystrokes for the command. Unlike Kurzweil Voice, you don't have to train DragonDictate to understand the new command because you've



BACKTRACK: Change incorrect words that you previously dictated by telling DragonDictate the correct word.

already issued it verbally.

DragonDictate has a commendable tolerance for ambiguous phrases that are part and parcel of everyday speech. For example, the correct command for capitalizing a new word is "begin capitalize," but

DragonDictate also accepted the commonly used "begin capitalization."

MODEST MEMORY REQUIREMENTS

Another plus is that DragonDictate has relatively modest memory requirements: DragonDictate's 30,000-word vocabulary requires about 12MB of system memory, while Kurzweil's Voice needs about 16MB of RAM for its 20,000-word vocabulary. DragonDictate also comes in versions with 5,000-word and 60,000-word vocabularies, which require 12MB and 16MB of RAM, respectively. On the downside, DragonDictate is very sensitive to unrelated sounds picked up by the microphone. Clearing of the throat four times resulted in the phrase "packaging defendant in Japan."

DragonDictate doesn't require a coprocessor, and it will work with several popular sound cards: Pro Audio Studio 16, Microsoft Sound System, Sound Blaster 16, and the M-Audio sound card from IBM (Dragon Systems sells the IBM card separately). We tested DragonDictate both with an M-Audio card and an uncertified Pro Audio Spectrum 16 and found

the two cards to be equally accurate, though the Pro Audio Spectrum 16 was a bit slower.

With its combination of accuracy and an innovative way of differentiating between dictation and commands, DragonDictate for Windows inches us closer to the time when voice recognition can replace keyboards, mice, and other input devices.

DragonDictate for Windows, Version 1.0.

List price: \$695; with certified sound card, \$995. Requires: 12MB RAM, 17MB hard disk space, Microsoft Windows 3.1 or later. Dragon Systems Inc., Newton, Massachusetts; 800-825-5897, 617-965-5200.

Circle 419 on reader service card.



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CIRCLE 079 ON READER SERVICE CARD

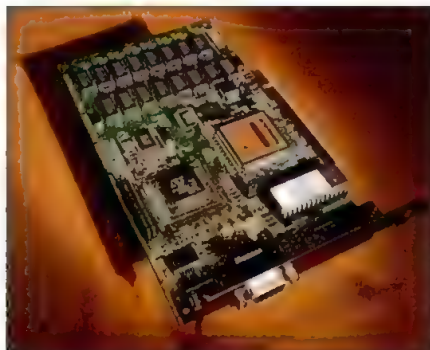
Video

Graphics Xpression: 64-bit Video for the Masses

BY JAMES KARNEY

ATI Technologies is aiming its 64-bit Graphics Xpression video adapter directly at budget-minded users who are willing to trade a little bit of performance—but not features—for a low price. The video adapter uses ATI's mach64CX accelerator chip, and is available in PCI, VL-Bus, or ISA versions that sell for \$179 with 1MB of memory and \$249 with 2MB.

The major difference between the Graphics Xpression and ATI's more expensive Graphics Pro Turbo is memory. The Graphics Xpression uses less expensive DRAM, which yields slower performance numbers; it's still faster than most other bargain accelerators, however. The board supports up to



BARGAIN VIEWING: Graphics Xpression is a budget 64-bit video card that doesn't skimp on features.

4MB of DRAM.

Graphics Xpression doesn't skimp on features, which include dynamic mode switching so that you can change to different resolutions and color depths without exiting Windows. That

means that you can easily switch between a high-end illustration package in 24-bit color and a word processor in 256 colors. The Graphics Xpression card supports the VESA power-down standard for monitors.

The package also includes slider-bar adjustments, preview test controls, controls for fine-tuning of monitor settings, reasonable color-calibration, and a first-rate virtual desktop.

Installing the Graphics Xpression is a two-step process that takes about 5 minutes. A DOS setup routine is used to match the card to your system and to select the monitor settings. Once that is complete, a Windows installation program is used to load drivers and the card's control panel.

All of these steps are automatic, although you can choose a custom installation instead and

override the defaults.

We tested a 2MB PCI Graphics Xpression in a 60-MHz Micron Pentium system. The board produced a good compromise between DOS and Windows performance with a DOS Graphics Video score of 3,596 and a Graphics WinMark score of 23.8 megapixels per second at 800-by-600 resolution with 256 colors (at 24-bit color, the score was 10.8 megapixels per second). This level of performance should be more than adequate for all but those heavily involved in graphics-intensive work.

The bottom line is that the Graphics Xpression performs at about 60 percent of the speed of high-end 64-bit adapters but costs about one-third as much, making it an equitable compromise between price and performance.

► **Graphics Xpression.** List price: With 2MB DRAM, \$249; 1MB DRAM, \$179. ATI Technologies Inc., Thornhill, Ontario, Canada; 905-882-2600; fax, 905-882-2620.

Circle 420 on reader service card

Scanners

DynamicPro 30: The Complete Scanning System

BY BEN MYERS

Envisions' \$2,999 flat-bed DynamicPro 30 is a powerful color scanner that is not intended for the casual user. This single-pass scanner is capable of producing 30-bit color images at up to 2,400 dots per inch (dpi) with quality that is comparable to expensive drum scanners. With the included transparency adapter, the DynamicPro 30 also does double duty: it can scan slides and paper images with equal fidelity.

The scanner, which is based on the UMAX PowerLook system ("More Bits for More Bucks," August 1994, page 46), is easy to set up and use. You can use either the included SCSI host adapter or any similar product that provides an Advanced

SCSI Programming Interface (ASPI). The scanner's manual provides ample explanation and photos that will help guide even the SCSI novice. We installed the DynamicPro 30 on a system equipped with an Adaptec 2840 VL-Bus SCSI host adapter. A Windows-based setup program guides you through installation of a Twain driver and supporting software. You select either the Twain driver for the Envisions SCSI adapter or the generic ASPI-compatible driver.

Whenever you request your application to acquire an image, the DynamicPro 30 software manifests itself as a large

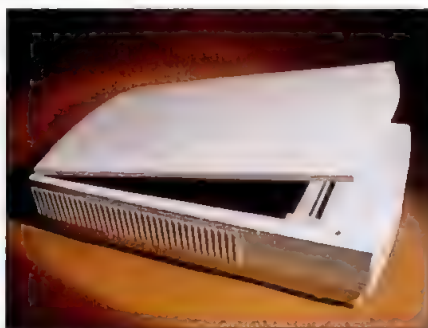
control panel. There are controls that let you choose either reflective or transparent image, color depth, scan resolution from 75 to 2,400 dpi, and the image dimensions. Graphic arts professionals will appreciate the program's controls for adjustment of scanner highlight, contrast, gamma values, and lamp intensity. You can tell the scanner to flip, rotate, invert, or reverse an image, or to do color adjustment and balancing while it is scanning. To make color separations,

you can scan only the red, green, or blue components of an image. In short, the control panel has just about any option you'll need to adjust scan quality at its source.

Envisions includes Adobe Photoshop and Kai's Power Tools with the scanner to provide the basis of an image acquisition and editing system. All you need is a computer with a lot of memory and hard disk space to hold the images that you scan and edit. If you need high-quality images in your work, you are likely to find that the DynamicPro 30 is an excellent value that could be the cornerstone of a professional imaging setup.

► **DynamicPro 30 Scanner.** List price: \$2,999. Requires: 8MB RAM, 25MB hard disk space, 1 ISA slot. Microsoft Windows 3.1 or later. Envisions Solution Technology Inc., Burlingame, California; 800-365-7226, 415-692-9061; fax, 415-692-9064.

Circle 417 on reader service card



TWO-WAY SCAN: The DynamicPro 30 can scan flat paper images or transparencies with the included adapter.

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CIRCLE 226 ON READER SERVICE CARD

■ Multifunction Devices

HP OfficeJet: Desktop Triple-Play Peripheral

BY ALFRED POOR

If you've got a typical small office, you have a computer, a printer, and a fax machine. The Hewlett-Packard OfficeJet combines a plain-paper fax, ink jet printer, and a copier into one convenient package that can save space as well as money.

The OfficeJet looks as if someone sawed off the front panel of a fax machine and grafted it onto an HP DeskJet 520 ink jet printer. It produces high-quality 600- by 300-dot-per-inch (dpi) resolution output, with HP's Resolution Enhancement technology (REt) to smooth jagged lines on text and graphics.

The front panel includes a scanner (with a 20-sheet input tray), as well as buttons that you can use to configure the printer and fax, to send faxes, and to make copies. The fax portion is Group 3 compatible—sending and receiving at 9,600 bps—and it supports three modes: standard (scanned at 203 by 98 dpi), fine (scanned at 203 by 196 dpi), and photo (halftone scanned at 203 by 196 dpi). If a fax is received while the printer is out of ink or paper, the machine will store up to 24 pages of incoming faxes for later printing.

In addition to faxing documents, you can also copy them; the OfficeJet prints the scanned images instead of sending them out through the phone line. You can make from 1 to 99 copies, and reduce the image by as much as 70 percent.

The unit comes with excellent documentation that clearly illustrates all the configuration and operation tasks. Some of these are a bit tricky, such as setting the header for outgoing faxes, but the tutorial section gives button-by-button instructions. There is a special driver

for Windows 3.1, which includes a background print spooler and a set of TrueType fonts.

The OfficeJet performed well in our tests. The printer is rated at up to 3 pages per minute (ppm) but managed no better than 2.5 ppm; actual print speed was a sedate 73 characters per second, which is similar to the performance of the DeskJet family.

The print quality on duplication paper was surprisingly good, and excellent on high-quality paper, where it looked as good as the output from many laser printers. Output for images with lots of dark or black areas tended to be a bit too dark, but there was little or no banding. In Photo mode, copies of pho-

tographs were as good as or better than copies made on a personal photocopier.

While a nicely focused product, the OfficeJet would be better if it had a few more features. Because there is no provision for printing to the fax portion of the OfficeJet, you must either have a fax modem in your PC or print the pages and fax them manually. In addition, there is no way to send the scanned image to your computer for editing or storage, which would have been a valuable extra.

Even without these missing links, the OfficeJet packs a lot of power into a petite package. The list price of \$959 is expected to result in a street price under \$800—making it less



PRINT, COPY, FAX: HP's OfficeJet combines the three most often used office peripherals into one box.

expensive than a separate plain-paper fax and an ink jet printer—which should make this an appealing value for small office operators.

► **Hewlett-Packard OfficeJet.** List price: \$959. Requires: parallel port. Hewlett-Packard Co., Santa Clara, California; 800-752-0900, 208-323-2551.

Circle 414 on reader service card.

■ Scanners

Scan a Line at a Time

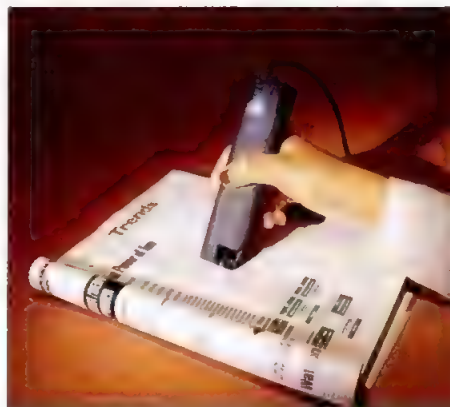
BY MARINO DELZOTTO

The DataPen, from I.R.I.S. America, is a hand-held scanner that looks like a highlighter. This \$399 scanner accurately transfers text from the printed page directly into any Windows application. Unlike most scanners, however, the DataPen takes in text one line at a time.

The DataPen works best on flat surfaces, with printed or typed text. The user must be sure the brightness switch on the DataPen is set to the correct option: bold text, normal text, or light text. If the switch is improperly set, accuracy will suffer and scanning speed will be below the claimed 100 characters per second.

We found the DataPen's

optical character recognition to be highly accurate. It's perfect for small jobs, such as scanning a few lines of text from an invoice or for students who



POINT AND SCAN: I.R.I.S.' DataPen can swallow chunks of text a line at a time.

need to put notes into a laptop. One of the most interesting potential uses is scanning a business card, which the

DataPen did with few errors, missing only a capital letter and a space between numbers in the ZIP code.

The most difficult aspect is DataPen's confusing manual. The DataPen requires a bidirectional parallel port, which was not pointed out anywhere in the materials. In addition, the scanner software must be reconfigured to enable printing—a potential source of confusion. While the scanner is enabled, Windows supplies an out-of-paper error message for the printer.

Handy and efficient, the DataPen can be an invaluable asset to a student or an executive.

► **DataPen.** List price: \$399. Requires: parallel port, 4MB RAM, Microsoft Windows 3.1 or later.

I.R.I.S. America, Boca Raton, Florida; 407-395-7831; fax, 407-995-9290.

Circle 415 on reader service card.

■ Personal Communicators

Sony's Magic Link Makes the Right Connections

BY CHRISTOPHER BARR

After a seemingly endless gestation period, the first personal intelligent communicator using the long-promised General Magic operating system has arrived. Sony's \$995 Magic Link PIC-1000 is a personal digital assistant with a bright new interface and built-in communications-based applications. Although it is still a work in progress, Magic Link comes closest to fulfilling the promise of a PDA.

Weighing 1.2 pounds, Magic Link is the first device to use the low-power Motorola 68349 processor; Sony says six AAA batteries or an optional lithium ion rechargeable battery should power the PIC-1000 for up to 10 hours of constant use. Slightly larger than a VHS videotape, the system has a touch-sensitive monochrome LCD screen. Like Bell South's Simon (and unlike the Apple Newton), Sony's Magic Link has no handwriting-recognition capabilities. Using a plastic pen, you can sketch or write notes and store them digitally, or use the on-screen keyboard; an optional keyboard plugs in for extended typing. The PCMCIA socket can be used for either a storage card or for a wireless pager.

The Magic Cap operating system has a graphical user interface that makes it easy to navigate simply by touching the pen (or your finger) to the icons. Designed by some of the original programmers of the Macintosh operating system, Magic Cap has a polished and uncluttered look. Using the unit is easy and—at times—whimsical. There is audio as well; for instance, simulated typing sounds that can be annoying or amusing, depending upon your attitude.

Magic Cap has three primary metaphors: a desk, the hallway,

and downtown. The desk contains an appointment book, an address book, and stationery for creating mail or taking notes. A desk drawer contains Pocket Quicken, a calculator, and a spreadsheet. The hallway is like a root directory with access to reference tools, system controls, and games. Downtown is where large applications reside. The first two are AT&T's new messaging service called PersonaLink, and America Online.

PersonaLink Services is the primary application that makes the Magic Link a personal intelligent communicator. Using its built-in fax modem, the PersonaLink account will send and receive messages to any x.400 service, such as AT&T's Easy Link and MCI Mail services, at 2,400 bps; faxes can be sent at 9,600 bps. In the future, AT&T will add shopping ser-

vices, stock prices, and news.

PersonaLink is the first service to incorporate Telescript, which is General Magic's communications-oriented language. Messages that contain Telescript



ORGANIZE: Sony's Magic Link places everything you need on a convenient desktop.

commands—or agents, as General Magic likes to call them—can modify your mailbox, reroute messages, and retrieve addressing information from senders. Once shopping and other services have been added to PersonaLink, Telescript agents can be sent to locate goods and services across

the network, notify you when a stock hits a certain price, or work out travel arrangements for you.

The \$995 Sony Magic Link PIC-1000 is only the start. Expect other iterations of Magic Cap with different focal points from Motorola, Toshiba, Fujitsu, Matsushita, and Philips in the coming months. What separates the Magic Link is its communications emphasis and its ability to connect to a number of services. The downside is you can't load the front ends to the DOS- or Windows-based communications or mail programs you use today; you'll have to be content using gateways, which can be slow or problematic.

► **Magic Link PIC-1000.** List price: \$995. Options: Rechargeable battery, \$69.95; PCMCIA pager, \$249.95; 1MB PCMCIA memory card, \$219.95; external keyboard, \$129.95. Sony Electronics Inc., Park Ridge, New Jersey. 800-571-7669, 800-556-2442; fax, 408-955-6605.

Circle 435 on reader service card

■ Diagnostics

Troubleshoot Your System with AMIDdiag

BY LENNY BAILES

American Megatrends, known mostly for their PC motherboards and BIOS products, has expanded the scope of its \$179 AMIDdiag diagnostic package to include end users as well as its traditional customer base of computer makers. The diagnostic program includes routines that look for problems with the motherboard, disk controller, video card, bus specifications, and multimedia peripherals; there is also built-in support for Microsoft's Plug and Play standard.

AMIDdiag provides standard hardware tests to validate the motherboard's CPU, coprocessor, interrupt controller, DMA channels, and system clock. If anything is seriously wrong with

the system or its major components, AMIDdiag will probably find it, but there is less diagnostic depth compared with Diagsoft's QAPLUS Professional. AMIDdiag includes fewer memory tests, omitting a search for bus noise or for memory bits stuck high and low. To the package's credit, the SYSINFO utility delivers a wide variety of useful information about the PCI or EISA bus, as well as the configuration of video cards, CD-ROM drives, SCSI adapters, and other installed peripherals. The maps of IRQ assignments, memory contents and hard drive configuration are

more complete than those that you would get with Norton Utilities or Quarterdeck's Manifest.

► **AMIDdiag, Version 4.5.** List price: \$179; upgrade, \$49.95. Requires: 512K RAM. American Megatrends Inc., Norcross, Georgia. 800-828-9264, 404-263-8181; fax, 404-263-9381.

Circle 434 on reader service card



LOCATE: AMIDdiag can locate and troubleshoot peripheral devices in your PC.

■ Diagramming

CorelFLOW Makes Drawing Charts Painless

BY ANGELA GUNN

The prospect of preparing anything more complicated than a simple organization chart has caused many a PC-literate executive to push the computer aside and sketch freehand on paper. However, with over 2,000 clip-art images and photos and 100 TrueType fonts, as well as a simple structure with which to use them, the \$99 CorelFLOW, Version 2.0, package makes producing complex diagrams and charts as painless as possible.

In a manner similar to Shapware's Visio, CorelFLOW starts with symbol libraries that are geared toward specific functions or jobs. CorelFLOW includes over 40 libraries on such topics as architectural renderings, landscape design, electrical schematics, network plans, and project-management Gantt diagrams, as well as those for flowcharts, logic diagrams, and organizational charts. While the program can be installed from floppy disks or a CD-ROM, to use the well-organized libraries of clip-art and photographs you'll need a CD-ROM drive.

The program's smart links automatically connect items that need to stay connected, regardless of whether they are moved. CorelFLOW makes good use of the right mouse button to call up the Property Manager, which speeds customizing the symbols and text. Throughout the process of building a diagram, CorelFLOW allows an impressive amount of control over the selection and placement of on-screen elements. You can drag and drop library items with ease and edit them to your specific needs. Text is easy to add, change, and move. The links between elements were always well behaved, and grouping and ungrouping a symbol was simple.

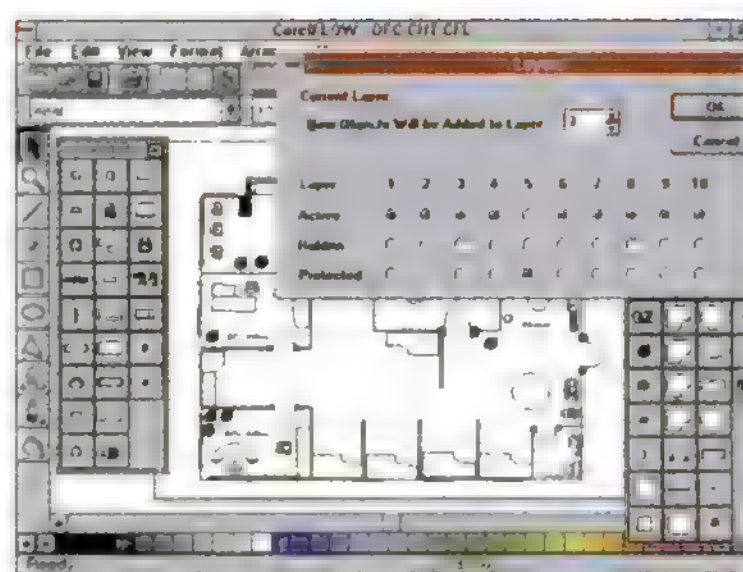
CorelFLOW allows hierarchical diagrams, in which clicking on an object in one diagram leads to another diagram. This stacking allows you to fit a large amount of data into a small space. Because the program is based on OLE, these hierarchical links can extend to other programs altogether, allowing the integration of video clips, among other things.

There were a few rough spots, including sporadic artifacting that would wipe out anything near an active text box. Less profound but still annoying was the single-level Undo that CorelFLOW affords. While it

lets you correct minor mistakes, such as choosing the wrong typeface, it doesn't allow the user to back out of a major mistake; all you can do is remember to save the diagram frequently or start over. We'd also like to be able to open multiple diagrams at once.

Inside and out, CorelFLOW is a beauty. You can justify the low price based on the great clip art and TrueType fonts you'll get, and you'll quickly find that it's a friendly, easy to use, powerful charting package as well.

► **CorelFLOW, Version 2.0.** List price: \$99. Requires: 4MB



STACK-A-CHART: Multiple layers allow you to separate different aspects of a diagram.

RAM, 5MB hard disk space (10MB for full installation), Microsoft Windows 3.1 or later; CD-ROM and math co-processor recommended. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-8200; fax, 613-761-9176.

Circle 421 on reader service card.

■ Icon Management

Putting a New Spin on Windows' Program Manager

BY ELISABETH HOLZER

The next release of Windows promises to bring you closer to your data by letting you open a file without first launching its application, but what can you do in the meantime? The \$79.95 SpinWizard Program Manager replacement lets you access up to 96 documents, stored procedures, and applications with one mouse click of its visually appealing icon carousel.

SpinWizard's rotating carousel houses icons in eight color-coded rows of 12, allowing you to organize your desktop and information in a variety of ways. For example, you might use one row for a current project's documents, invoices, and schedules; one for your favorite Internet haunts; one for your weekly network maintenance procedures; and one for communications

applications. The possibilities are endless. The carousel can be either hidden or displayed and is resizable. In its most useful form, the carousel occupies a quarter of the screen.

Programs or files can be launched either by clicking on the icon or by using one of the

carousel is easy and intuitive.

We found recording procedures as icons to be awkward, however. If the procedure you're recording includes launching an application, for example, you must use the Program Manager's File menu to do so rather than simply clicking the program icon. In addition, the macro recorder does not support non-Windows applications and stops recording once you bring up the DOS prompt. Thus, while DOS applications

can be accessed from carousel icons, associated documents can't.

Overall, the SpinWizard program offers an improvement



ROUND-AND-ROUND: SpinWizard defines a new standard for compactly displaying icons.

corresponding 12 function keys.

Installation and setup are simple and easy. SpinWizard automatically loads most of your applications into the carousel. You load the rest either by dragging and dropping program icons directly from the File Manager or by right-clicking on an empty cell in the carousel, which brings up a dialog box. Rearranging or deleting icons from the

over the File Manager even if you only use it to store program icons. By spending a little time customizing the program, you can put all your network and local data at your fingertips.

► **SpinWizard.** List price: \$79.95. Requires: 4MB RAM, Microsoft Windows 3.1 or later. Tanisys Technology Inc., Austin, Texas; 800-460-7746, 512-263-1700; fax, 512-263-1683.

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486DX2-50	\$1545 Lease \$57/mo.	\$1845 Lease \$68/mo.	\$2345 Lease \$86/mo.	\$2845 Lease \$104/mo.
486DX2-66	\$1595 Lease \$58/mo.	\$1895 Lease \$69/mo.	\$2395 Lease \$88/mo.	\$2895 Lease \$106/mo.
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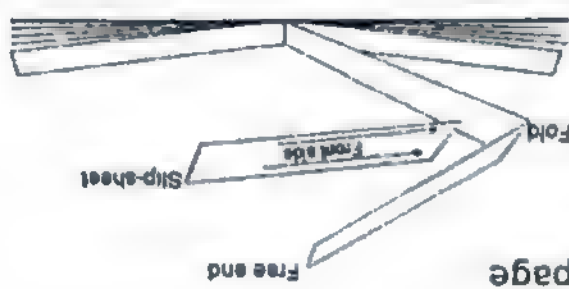
1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page
2. Arrow pointing to the fold

3. Slice the folded edge

4. Close the page and slip-sheet



1. Front side touching the free page

2. Arrow pointing to the fold

3. Slice the folded edge

4. Close the page and slip-sheet

Inverted Foldout slip-sheet



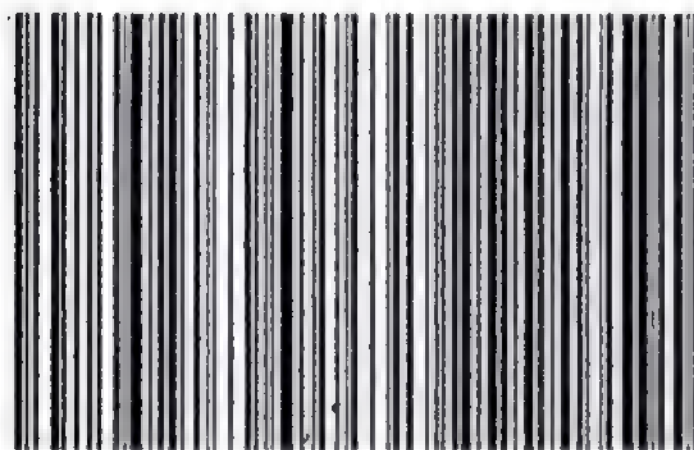
GbsSlipSheet-001

Folded edge of the page

Foldout slip-sheet

1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

We're Racking 'Em Up.



April 12, 1994
Pentium-66
June 28, 1994
DX4-100



April 1994
Pentium-60
August 1994
Pentium-90



January 1994
486DX2-66
February 1994
486DX2-66
March 1994
486DX2-66
June 1994
486DX2-66
June 1994
Pentium-66
July 1994
Pentium-66
August 1994
Pentium-66
August 1994
Pentium-90
September 1994
Pentium-66
September 1994
Pentium-90
October 1994
DX4-100
October 1994
Pentium-90



May 1994
Pentium-66



June 1994
Pentium-66
August 1994
Pentium-90



March 1994
486DX2-66

ZEOS is on an award-winning streak...with no end in sight. Unmatched in its success, our Pantera line continues to rack up top industry awards—month after month.

Experts agree that the Pantera—based on Intel's Pentium, DX4 and 486 processors—is your sure shot.

Computer Shopper said: "ZEOS set the standard."

"The clear winner was the ZEOS Pantera. Its scores were the best across the board," reported *Windows Sources*.

PC/Computing concurred: "Rocket-fast performance and a great price make this our favorite Pentium of the lot."

Continuing with the ZEOS tradition of providing you with top performance, unwavering reliability and exceptional value, the ZEOS Pantera is unrivaled in its field.

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The Pantera's supreme power and game-winning performance begins with a ZEOS designed motherboard, one that is created specifically to take full advantage of the latest technological

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Unmatched in performance, reliability, and value, the ZEOS Pantera "is the ultimate Power Desktop." As *PC World* said: "It's lightning fast, beautifully configured, and priced right. That's what power Best Buy is all about." To get your sure shot, call a ZEOS Systems Consultant now at 800-554-7172.



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486DX2-66 \$1895
Pentium-60 \$2245

Package #2:

- 8MB RAM
- 528MB local bus IDE hard drive, 256K cache
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- PCI local bus SVGA video
- SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse



486DX2-66 \$2345
Pentium-60 \$2695

Top Gun:

- The above system modified to include:
- 256K SRAM cache
 - Diamond Stealth 64/PCI local bus graphics card with 2MB VRAM
 - 15" SVGA color monitor upgrade
 - 14.4/14.4 send/receive fax modem
 - Choice of Lotus Windows application



PC DX4-100 \$2795

Editors' 100:

- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive, 256K cache
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64/PCI local bus graphics card with 2MB VRAM
- 14" SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Choice of Lotus Windows application



Pentium-66 \$2995
Pentium-90 \$3095

Editors' Choice:

- The above system modified to include:
- 15" SVGA color monitor upgrade
 - 10-bay vertical case



Best Pentium-66 \$3538
Pentium-90 \$3638

Best MM:

- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive, 256K cache
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- 16-bit sound card, stereo speakers
- Diamond Stealth 64/PCI local bus graphics card with 2MB VRAM
- 17" SVGA color monitor
- 10-bay vertical case
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Choice of Lotus Windows application

Pentium-90 \$4395

Best MM Supreme:

- The above system modified to include:
- 24MB RAM
 - 1GB local bus IDE hard drive, 256K cache
 - Altec Lansing high-power speakers



486SX-33 \$1195

Package #1:

- 4MB RAM, 128K SRAM cache
- 214MB hard drive, 32K cache
- 3.5" 1.44MB floppy drive
- VESA local bus SVGA color video
- SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse



486SL-33 \$1995

Package #3:

- 8MB RAM
- 260MB IDE hard drive
- Internal 96/24 send/receive fax modem
- Custom carrying case
- Extra battery
- External charging stand
- MS-DOS, Windows for Workgroups
- 8.5" to 11.3" x 1.75" to 2.25"; 5.6 lbs.



DX4-100 \$3095

Package #3:

- 8MB RAM
- 350MB IDE hard drive
- External 3.5" 1.44MB floppy drive
- Custom carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- Lotus Organizer
- 7.8" x 10.2" x 1.7"; 3.9 lbs.

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2 For same-day shipping, call ZEOS at 800-554-7172 before 1 p.m.

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3 Upon credit approval, we'll ship your system *the same day you order!*

Our Guarantee:

If we accept your order for immediate shipment and fail to ship your system under the conditions outlined, we will ship it *at our expense* as soon as it is ready.*

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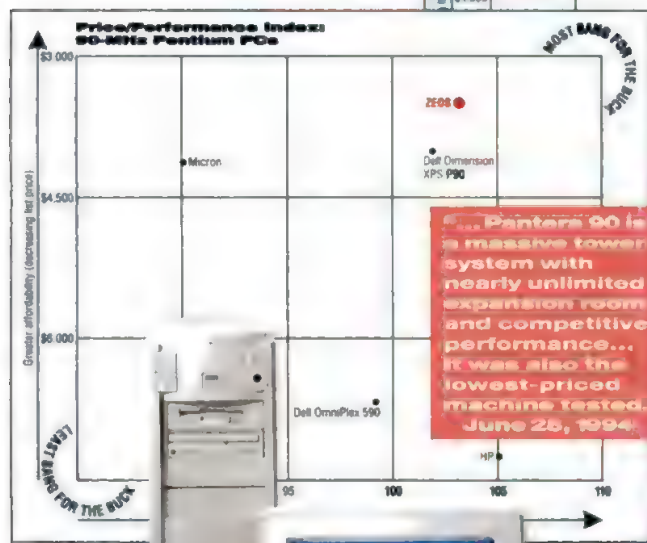
*Orders must be for a *Computers Now!* configuration; we do not ship just a sampling here. Since we continuously update this list of configurations, please call to confirm your system is on the list. This offer is good only as long as there are pre-built systems remain in stock. Other ZEOS systems and custom configurations may take slightly longer—about a week. All orders are subject to credit approval. Monitor upgrades available on all desktop *Computers Now!* packages. Orders must be received by 1 p.m. Central Time, MT.
Purchase orders are subject to approval. Business leasing programs available—lease prices based on a 40-month lease, 10% purchase option. All prices, specifications and availability are subject to change without notice; call to confirm these and warranty details. Prices do not include shipping. *Now!* compatibility is Developer Tested Only. *Now!* makes no warranties with respect to this product. The Energy Star emblem does not represent EPA endorsement of any product or service. All products and company names are trademarks or registered trademarks of their respective holders. Intel Inside and Pentium Processor Logos are trademarks of Intel Corporation. ZEOS and *Computers Now!* are registered trademarks. *Computers Now!* is a registered service mark. Panters is a trademark of ZEOS International Ltd. ©1994 ZEOS International Ltd. 1181 Industrial Blvd., Minneapolis, MN 55411 (USA). ZEOS is a publicly traded company (NASDAQ symbol: ZEOS). Print PCH 9408

CIRCLE 155 ON READER SERVICE CARD.

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"The ZEOS Pantera 90
offers the most bang
for the buck."

September 27, 1994

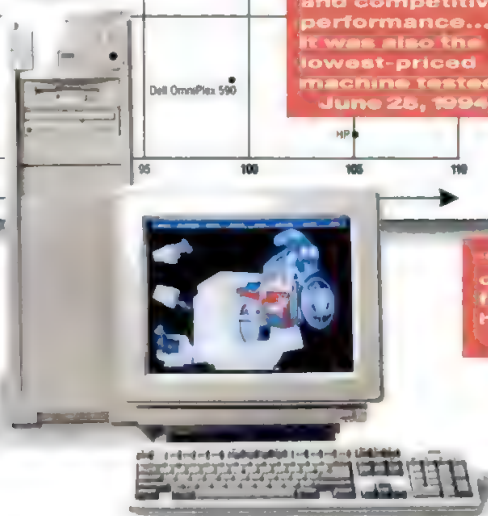
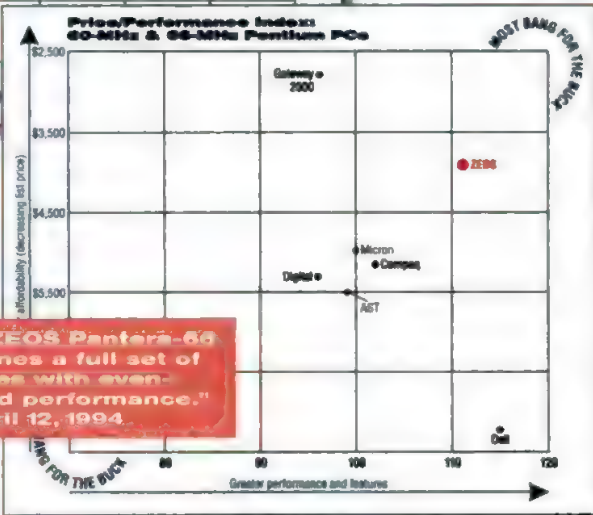


"The Pantera 90 is
a massive tower
system with
nearly unlimited
expansion room
and competitive
performance...
It was also the
lowest-priced
machine tested."
June 26, 1994

"The ZEOS Pantera-66
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features with even-
handed performance."
April 12, 1994



"For the best value
in a DX4/100-based
system, look to...
ZEOS International."
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Time after time, ZEOS computers have repeatedly been tested against the competition and repeatedly beat all others hands down. In *PC Magazine's* price and performance comparisons of technologically-advanced systems from leading computer companies, ZEOS was the unbeatable value.

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Image Editing

Elastic Reality: The Power to Morph like the Pros

BY DANIEL GROTTA AND SALLY WIENER GROTTA

When you see attention-grabbing morphing or warping of images on television or in the movies—such as Odo in “Star Trek: Deep Space Nine” morphing from his humanoid shape into a chair, or Jim Carrey’s face in the movie *Mask* warping into astonishing extrusions—chances are that the software used to create them was Elastic Reality. Originally dedicated to Silicon Graphics workstations and recently ported to Apple’s Macintosh and PowerMac plat-

giving a wide variety of overall special effects.

Animation of the transformation between the two images in Elastic Reality uses a process called *tweening*. You start by defining what the key frames will look like; the program then will create the intermediate frames automatically. The compositing and matte tools also provide sophisticated professional results, using simple techniques such as the automatic matte-generator. Layering allows for compositing different levels of depth that put transforming objects in front of each

other; for example, a person standing in front of a house gets morphed into an animal in front of a barn.

The Elastic Reality package comes with TransJammer, a transition-generating application. There are more than 60 rather impressive resolution-independent transitions

that you can edit or add to. In addition to supporting most popular file formats, effects created by the Windows version of Elastic Reality can be used by the Silicon Graphics version, and vice versa.

The six disks install Win32 (for 32-bit processing in Windows), Video for Windows, and TransJammer, as well as Elastic Reality’s files and sample images. Using the easy-to-follow tutorials, you can create your first morph, warp, or transition within minutes. The documentation is well written and intelligently organized.

What sets Elastic Reality apart from other, less expensive

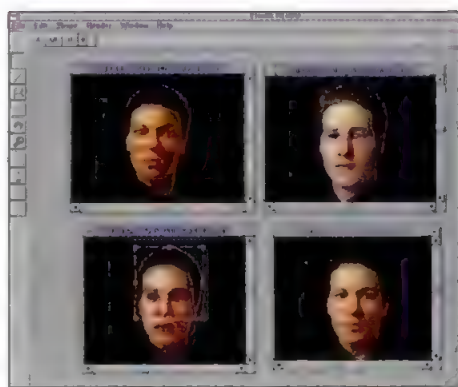
and less powerful morphing programs is that it is a serious 32-bit graphics workhorse that is capable of producing highly creative, professional-quality special effects with comparative ease and speed. Elastic Reality is both comprehensive and relatively easy to use, and it provides you with the tools to create a polished, Hollywood-quality project.

► **Elastic Reality.** List price: \$495. Requires: 4MB RAM, 8MB hard disk space, Microsoft Windows 3.1 or later; math

coprocessor recommended.

Elastic Reality Inc., Madison, Wisconsin; 800-642-4122, 608-273-6585.

Circle 416 on reader service card.



MORPH: Elastic Reality’s Shape-to-Shape interface links two images for morphing by superimposing them.



WARP: Elastic Reality can blend the key features of two images into one. The bottom picture is the result of the warp.

forms, Elastic Reality is now available for PCs running Windows for \$495.

Elastic Reality uses simple drawing tools (Bezier, freehand, rectangle or ellipse) to identify the areas for morphing or warping transformations. The lines and shapes are easily edited and perfected. In addition, barriers may be drawn around portions of your picture that you want to remain unchanged. This Shape-to-Shape interface provides a higher degree of control, smoothness, and creativity than simpler programs that use dots and vectors. What’s more, several transformations can be activated at once at different rates,

■ An Easy Route to Special Effects

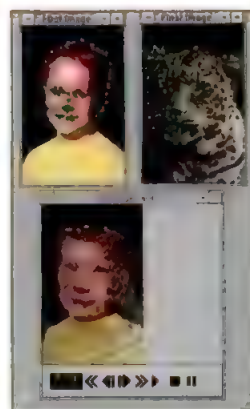
RomeBlack’s xTransit is a \$79.95 special-effects program that is to professional quality special-effects software what the family camcorder is to a Hollywood movie camera. While it is capable of producing stunning results, is easy to use, and is based on flexible creative tools, xTransit is not a substitute for an effects powerhouse.

No drawing skills are needed. xTransit simply requires the placement of control points, or dots that define the size and shape of the area to be morphed or warped. The more dots, the smoother and more well-defined the area, and the more natural the image transition. xTransit’s preview feature is superb, allowing you to see the result of your choices on any frame in the project.

Although it lacks Elastic Reality’s scope and versatility, xTransit includes 25 different simple-to-use, visually interesting transitions, such as Fish Eye, Mosaic, and Vortex.

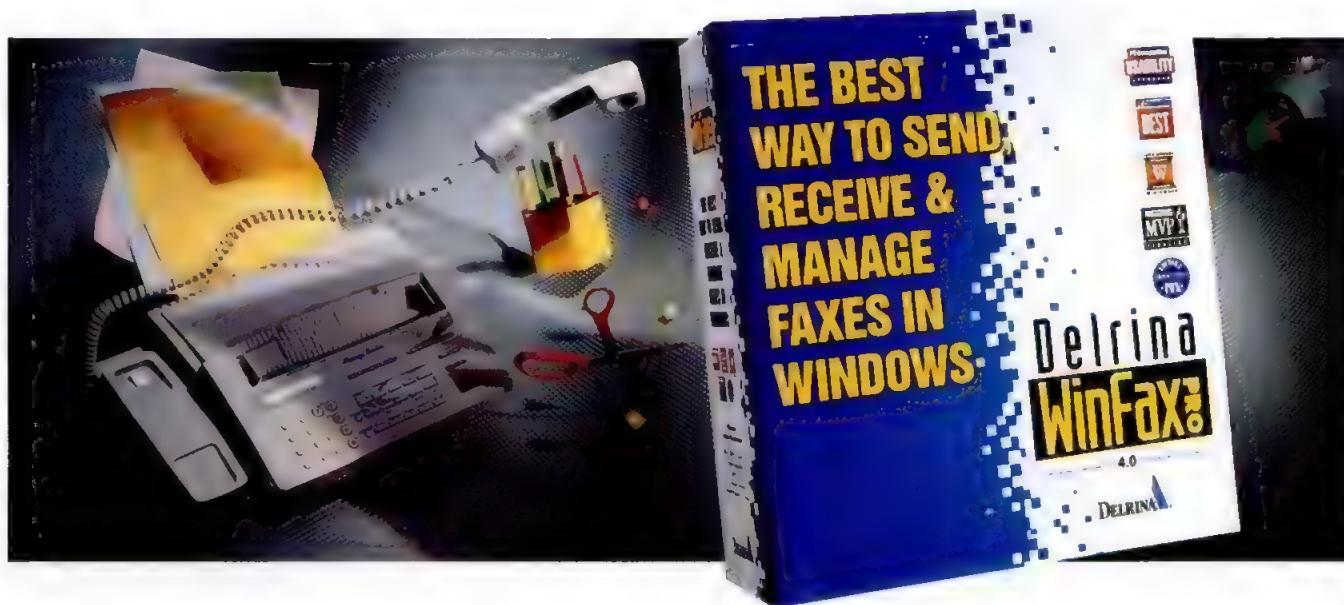
The program is easy to install, configure, and use; it supports over a dozen popular file formats including .AVI, TIFF, and Photo CD. Unfortunately, the documentation is a skimpy 76 pages, filled more with definitions than examples or tips.

But control isn’t the central purpose of xTransit; it’s designed more for entertainment than productivity. Even so, xTransit is capable of creating spectacular-looking special effects with minimum hassle. For more information call RomeBlack at 800-987-2674.—DG and SWG



CONNECT THE DOTS: With xTransit, special-effects shapes are defined by placing control points on the element’s outline.

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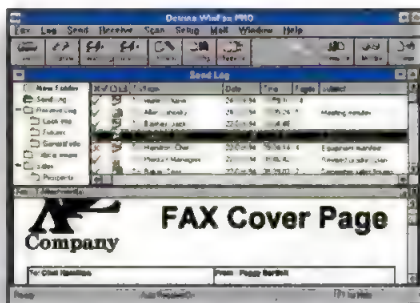
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That's what *PC/Computing* said about version 3.0. And now we've made it even better.

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There's added convenience with dozens of ready-to-use cover pages. Fax phonebooks that are drag-and-drop simple. And improved fax annotation tools that even let you add your signature.



Based on extensive usability testing, the new customizable interface includes folders for organizing sent and received faxes.

Don't try this with a fax machine.

Imagine faxing, not just an image of a document, but the actual file itself*, so it's ready to be used in an application. Imagine sending a single document that is automatically faxed to some people and e-mailed to others.

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*Requires Class 1 modem.

CIRCLE 250 ON READER SERVICE CARD

File Transfer

LapLink for Windows Takes Control of Remote PCs

BY BEN GOTTESMAN

In moving from DOS to Windows, LapLink has branched out from its initial focus—point-to-point file transfer—to support multiple simultaneous connections and remote control. Traveling Software's \$199.95 LapLink for Windows, Version 6.0, is a one-stop connection center for the PC that despite some growing pains is extremely useful, particularly for those who must remain connected while they travel.

LapLink lets computers talk to each other in three different ways: by traditional file transfer, by remote control, or with a handy chat feature. The program includes the cables for direct parallel or serial connections. You can also connect to other systems via a modem or an IPX-based network. Wireless connections can be made through the National Semiconductor AirShare modules when used with LapLink Wireless.

Unlike its competition, LapLink supports multiple simultaneous, heterogeneous (for example, cable or network) connections. This opens LapLink up to a whole new class of applications, such as remote monitoring of print and communications servers.

POINT-TO-POINT

At the same time, LapLink remains true to its roots, continuing to excel at file transfer. The program adds a lot of overhead at the beginning of a file transfer, but once it gets going, transfer speed is impressive. The program's SpeedSync technology

lets you transfer only the changes made to a file rather than the whole file. Using SpeedSync, the time needed to move a 2.5MB database dropped from over 15 minutes to about 2.5 minutes. This reduction in transfer time makes LapLink particularly appropri-

loaded and did not work; users will need to temporarily unchain the driver to modify the graphics card's resolution.

WHO CONTROLS WHOM

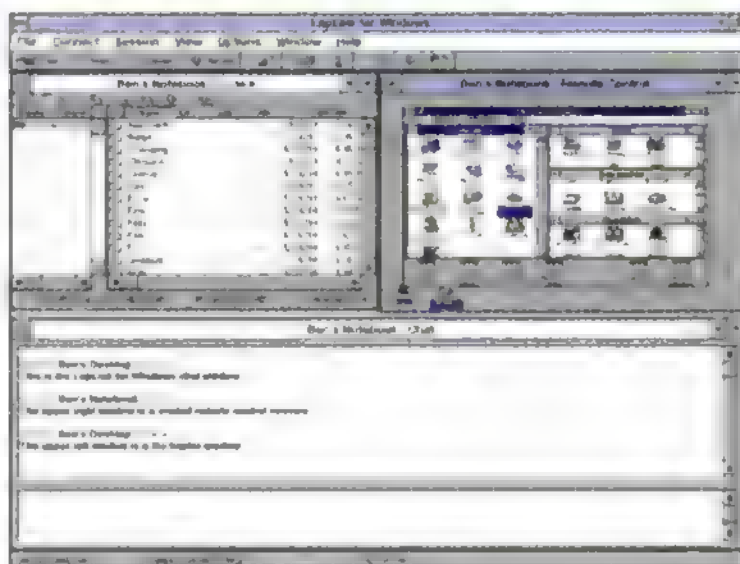
Most remote-control programs clearly differentiate between the host computer—the system being controlled—and the guest computer—the system in control; LapLink for Windows makes no such differentiation. Users can choose at any time during the connection who controls whom—the two can change roles during a session. The only limitation is that you obviously can't be both host and guest at once.

Unfortunately, there is no "Wait for Connection" option. If you've enabled the program's modem module, it makes the modem unavailable to other applications.

When controlling another PC, LapLink allows the host to be viewed full screen or scaled into a window on the guest. This is extremely useful for dealing with resolution differences, such as viewing an 800-by-600 desktop screen on a laptop's 640-by-480 display.

SCREEN CACHING

Transfer of the host system's screen to the guest's PC is reasonably fast. Over a parallel port cable, screen updates were instantaneous. Over a 14.4-kbps modem and phone lines, the wait for updates was slower, but still tolerable. The program caches frequently used elements of the screen during a session to improve drawing speed.



REMOTE VIEWING: LapLink for Windows lets you view the host PC either as a full or partial screen.

ate for remotely operating Windows applications.

The addition of remote-control capabilities puts LapLink in the same league as Symantec's pcAnywhere, Ocean Isle Software's ReachOut Remote Control, and Triton's CoSession.

In order to permit a system to be controlled by another, all remote control programs modify the system's Windows startup file. While most replace the keyboard driver, LapLink for Windows chains the video driver, intercepting GDI calls and passing them on to the video driver. This allows remote control of another PC at any video resolution and color depth; other programs are limited to 1,280-by-1,024 resolution at 256 colors.

However, we noticed that the ATI Mach32 and Genoa 8500VL driver utilities on two of our test systems no longer recognized that their drivers were

Despite its obvious strengths, there were a few disappointments. LapLink for Windows supports neither drive nor printer redirection. While drive redirection (available in LapLink Remote Access) is relatively new in the remote-control arena, printer redirection is included in all the major remote-control packages. The lack of the ability to send output from the host to the guest's printer means you can't print a remote file on a local printer.

Often the user is in the dark about what is going on and who is in control. There is little indication on a host system about what a guest is doing. When LapLink runs in a window, the user sees that a connection has been made, but cannot tell if files are being transferred by the remote user. Also, if the program is minimized, there is no ongoing indication that a remote user may be monitoring your system. Other programs animate the program icon or provide some other indication of an active connection. Finally, LapLink is hungry for system resources and can easily overwhelm a PC, preventing you from running too many other applications.

LapLink for Windows is a must upgrade (\$79.95) for LapLink DOS users that have made the move to Windows. The inclusion of remote control pushes LapLink up a rung on the ladder, but also means users will be more critical of flaws and gaps. If you can tolerate some of the rough edges, LapLink should be on your short list. For file transfer only, it's the one to choose; for remote control, it is one of many but among the better choices.

► **LapLink for Windows, Version 6.0.** List price: \$199.95 (upgrade, \$79.95). Requires: 4MB RAM, 6MB hard disk space, Microsoft Windows 3.1 or later. Traveling Software Inc., Bothell, Washington; 800-343-8080, 206-483-8088; fax, 206-485-6786.

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Canon

■ Multimedia

Zenith Z-Player: Sound and CDs For Those on the Go

BY TIN ALBANO

Chances are that sooner rather than later, your notebook is going to need a CD-ROM drive and a sound chip. CDs are the format of choice these days for distributing software, and multimedia programs demand both CD-ROM and sound capabilities. One of the best portable multimedia solutions we've seen so far is the \$499 Z-Player from Zenith Data Systems.

An external CD-ROM player and speaker system in one, the Z-Player lets users take multimedia presentations on the road without having to lug around multiple components or heavy docking stations or wrestle with a tangle of data, speaker, and power cords. The 2-pound unit (including battery) can connect to most portable computers with 512K VRAM and a Type II PCMCIA slot.

The 1.2- by 10.6- by 7.8-inch Z-player contains a double-speed CD-ROM drive and an integrated 16-bit stereo sound circuit. The Z-player can play back either computer CDs, photo CDs, or standard music CDs through its stereo speakers. The unit runs on a single rechargeable nickel cadmium battery pack or six AA size batteries; an AC adapter is included as well. The batteries give you from 30 to 45 minutes of continuous use with CD-ROMs or 1 to 2 hours of continuous audio playback.

The Z-Players double-speed CD-ROM drive is MPC-compatible, has a transfer rate of 300K per second, and an average access time of 300 ms. The audio component of the Z-Player supports 16-bit stereo sound and a 24-voice FM music synthesizer. The only real shortcoming of the Z-Player are its built-in speakers. While certainly adequate for most business purposes, the

speaker sound quality does fall below external units from Altec-Lansing or Bose. There are jacks for headphones and external speakers, however, so those who want better sound quality can simply plug in.

That aside, the Z-Player is more than the first self-contained sound machine for travelers; it is the handiest way to take audio and CD-ROM with you

wherever you go. Even with the advent of CD-ROM and sound-equipped notebooks in sight, the cost of these systems will be prohibitive. At \$499, the Z-Player is a bargain upgrade that will put multimedia capabilities on your laptop.

► **Z-Player.** List price: \$499. Requires: Type II PCMCIA Slot, 512K VRAM. Zenith Data Systems, Buffalo Grove, Illinois;



MULTIMEDIA ADD-ON: The Z-Player brings MPC-compatible performance to notebooks.

800-533-0331, 708-808-5000; fax, 800-472-7211.

Circle 437 on reader service card.

■ Portable PCs

Dell Latitude XP: Notebook Practice Made Perfect

BY MELISSA PERENSON

With the debut of the Latitude XP line of notebooks, Dell reenters the high-end notebook arena in style and is set to eradicate the memory of its last foray into notebook manufacturing. This time around, Dell's notebooks are technologically up to date and priced in line with—if not lower than—comparable systems from Compaq, IBM, NEC, and Toshiba.

Even at a hefty \$4,799 (for the 100-MHz 486DX4 4100CX machine we tested), the unit still seems like a bargain when compared with its competition's prices for a 100-MHz system equipped with a 9.5-inch active-matrix display, 1MB of video RAM, a 340MB hard drive, and 8MB of RAM. Dell also offers lower priced units with DX2/50 and DX4/75 Intel processors, as well as dual-scan color screens; Dell does not offer monochrome displays on the Latitude XP line. About the only thing the XP lacks are built-in audio and a large screen option.

The Latitude XP's removable

IDE hard drive gives you the potential for an infinite degree of data storage expansion, as well as the security of being able to have different hard drives for different purposes (or even users). Additional expansion is offered



LATITUDE XP: Dell packs a 100-MHz punch in its newest notebook.

by the PCMCIA slots, which support one Type III and two Type II cards; count on using one of these for your modem because the XP does not have a dedicated internal-modem slot. If you find the standard 8MB of RAM insufficient for your needs, adding memory upgrades (up to 36MB) to the two accessible SIMM slots is easy.

Dell has also paid attention to the details. At 8.7 by 11 by 2

inches, this compact 6.1-pound machine is neither awkward nor unwieldy. There's a sturdy, spacious full-function keyboard with a built-in wrist rest, collapsible feet for an ergonomic incline, and a well-placed centered trackball whose oversized buttons make this integrated pointing device one of the easiest to get used to.

The Latitude XP can automatically sense and switch to international voltages, and the power pack is pleasantly unobtrusive. With the touch of a button, the easy-to-remove lithium ion battery's incremental gauge will light up, indicating how much power remains; a more precise reading is given by a battery status icon, which can be on-screen at all times.

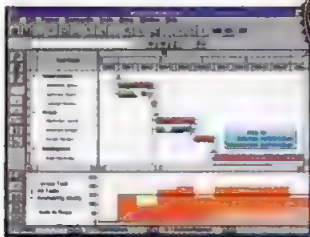
The performance of the Latitude XP was midrange, with Windows video being the stand-out score. Under ZDigit testing, the Latitude XP was able to go for 3 hours 40 minutes between charges. Feature-rich and ergonomically designed, these machines mark a successful return to the notebook fray for Dell Computer Corp.

► **Dell Latitude XP 4100CX.** List Price: With 8MB RAM, 340MB hard disk, active-matrix display, DX4/100 processor, \$4,799. Dell Computer Corp., Austin, Texas. 800-613-3355, 512-338-4400; fax, 800-727-8320. Circle 436 on reader service card



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■ Pointing Devices

There's a Mouse in the House

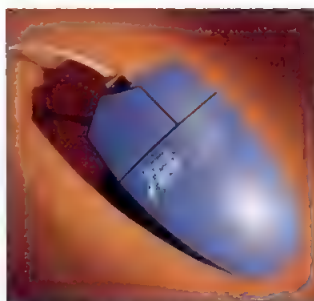
BY GAYLE C. EHRENMAN

If you miss the Dove Bar design of the original Microsoft Mouse, or if you've been craving a pointing device that puts the fun back in functional, look no further. The Microsoft Home Mouse meets both these needs.

Designed specifically for home computer users, this \$39 mouse wraps the optomechanical design of the Microsoft Mouse

2.0 in a blue case that looks just like a little house. The two buttons on the mouse are peaked like a roof, and the cord connects through a red chimney. This mouse is smaller, making it more comfortable for kid-sized hands but still suitable for adult use.

What really distinguishes this pointing device is its IntelliPoint software. More than just a series of drivers, the IntelliPoint software gives users a mind-numb-



HOME POINT: The Home Mouse has peaked roof buttons and a red chimney-cord connector.

ing array of options for customizing the mouse's appearance and performance. There is

a vast library of pointer icons, ranging from dancers to work tools, with which to replace the traditional arrow. A library of special effects attaches animation and sound effects to your mouse actions. Use these effects at your own risk; they're fun but can make it tough to see where you're pointing.

► **Microsoft Home Mouse.** Estimated street price: \$39. Requires: Microsoft Windows 3.1 or later, serial port. Microsoft Corp., Redmond, Washington; 800-426-9400, 206-882-8080; fax, 206-936-7329

Circle 424 on reader service card

■ Portable PCs

HP 200LX Quickens Your Expense Account

BY CHRISTOPHER BARR

Hewlett-Packard's littlest computer just got better. With the addition of Pocket Quicken, you can now use the HP 200LX to keep track of your expenses. Two versions are available: A 1MB RAM version that costs \$549 and a 2MB RAM unit priced at \$699.

This DOS 5.0-based pocket-PC has several vital applications stored in ROM that make the 200LX an organizer, calculator, spreadsheet, and communicator. This neat package weighs less than a pound.

Many users find the appointment and telephone books the most useful functions, but the addition of Pocket Quicken lets you enter expenses as they occur and upload your records to desktop Quicken for preparing expense reports.

Pocket Quicken is a subset of Quicken for DOS; it will not track stocks or let you pay bills on-line, but using the optional \$119 connectivity pack that comes with software and a serial cable you can synchronize specific bank, credit card, or cash accounts. Pocket Quicken is also available on the Tandy Zoomer

and will also be available on Sony's expected Magic Link personal intelligent communicator.

The HP 200LX is more than an electronic organizer. It comes with communications software that allows you to connect to on-line services and has cc:Mail Remote built-in. The Type II PCMCIA socket accepts modems (we installed a Megahertz 14.4 XJack fax modem) as well as storage cards. The device's infrared port can communicate with other HP devices, including printers and Omni-Books.

While the HP 200LX may seem underpowered next to a full-size notebook, its size, weight, and functionality make



HP 200LX: The addition of Pocket Quicken helps you get a handle on daily expenses.

it hard to leave home without it.

► **HP 200LX.** List price: With 1MB RAM, \$549; with 2MB RAM, \$699; Connectivity Pack, \$119.95. Hewlett-Packard Co., Corvallis, Oregon; 800-333-1917, 303-635-1000.

Circle 425 on reader service card.

■ CD-ROM

Compact Porta-Drive T4100 Moves Data on the Road

BY BRAD STILWELL

CD Technology's \$500 CD Porta-Drive T4100 is the lightest way for business users to take their heavy data on the road. Unmatched in its portability, this 1- by 6- by 8-inch double-speed CD-ROM drive weighs a mere 2.2 pounds with its parallel-to-SCSI adapter.

You might find portable

readers that are faster than the T4100 or ones that have larger buffers than its 64K, but none are as compact. Because CDs are attached directly to the T4100's spindle, the drive will operate in almost any position.

When it comes to multimedia playback, the 300-kilobytes-per-second throughput of this double-speed drive suffers the same performance limitations of all



HANDFUL OF DATA: The Porta-Drive T4100's double-speed throughput works well for data applications.

portable drives that rely on a parallel port. We connected the T4100 to an 8MB Toshiba

Satellite T1900C through the recommended \$125 Trantor 348 parallel-to-SCSI interface. Unfortunately, VidTest results showed the unit dropped more than 90 percent of the video frames in a variety of AVI clips.

If moving data is your goal, however, the CD Porta-Drive T4100 should prove a reliable travel companion.

► **CD Porta-Drive T4100.** List price: \$500; Trantor 348 parallel-to-SCSI adapter, \$200. CD Technology Inc., Sunnyvale, California; 408-752-8500; fax, 408-752-8501.

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For more information or the name of your nearest HP dealer, call us today at 1-800-322-HPPC, Ext. 8567. And tune in to the network superstars.

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If you're connecting PCs to a network, scan this chart and you'll see it's time to hook up with HP.

STANDARD NETWORKING FEATURES	HP VECTRA XM2/EC	HP VECTRA ML/PC	COMPAQ DESKPRO/XE	DELL NETPLEX
Advanced Bus Architecture	PCI	VL		
Integrated Networking Interface	32-bit	16-bit		
Integrated, multiprotocol Boot-ROM	X	X		
ISA Plug-n-Play Compliant	X	X	X	
Multilevel Security Features	X	X	X	X
Asset tracking	X	X	X	
PC tattooing	X	X	X	
Optional Desktop Management Software	X	X		
Bi-directional parallel port	X	X	X	X
Desktop Management Interface (DMI) ²	X	X		



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- Ultra VGA2 local-bus accelerated video supporting up to 1280 x 1024 resolution

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- One available 32-bit VL-bus slot
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- 32-bit Fast-IDE local-bus hard disk interface
- 8-MB RAM, expandable to 96-MB

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- PCI architecture
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- Two available 32-bit PCI expansion slots
- 210-MB, 14-ms Fast-IDE hard drive¹
- 32-bit PCI IDE hard disk interface

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- Four mass storage shelves (three front accessible); five expansion slots
- Two available 32-bit PCI expansion slots
- 270-MB, 12-ms Fast SCSI-2 hard drive¹



HP Vectra VL2

- Desktop Power Management
- EPA Energy Star certified
- Local bus Fast-IDE hard disk interface*
- 1280 x 1024 video resolution*
- Optional 128- or 256-KB cache memory*
- Free three-year limited warranty for parts and labor²

HP Vectra N2

- 1 MB of video RAM standard, expandable to 2 MB
- Slimline package with two mass storage shelves and three ISA slots
- Optional integrated 10Base-T networking
- Multilevel security
- EPA Energy Star certified
- ISA Autoconfiguration utility (Plug-n-Play)
- Integrated Desktop Management Interface (DMI)³
- Free three-year limited warranty for parts and labor²

HP Vectra M2

- Ultra VGA2 local-bus accelerated video supporting up to 1280 x 1024 resolution
- Optional integrated 10Base-T networking
- Systems Diagnostics Utility
- EPA Energy Star certified
- ISA Autoconfiguration utility (Plug-n-Play)
- Integrated Desktop Management Interface (DMI)³
- Free three-year limited warranty for parts and labor²

HP Vectra XM2

- 8-MB RAM, expandable to 96-MB
- PCI Integrated 64-bit S3 Vision-864 graphics accelerator supporting up to 1280 x 1024 resolution
- Optional PCI Integrated 32-bit 10Base-T networking
- Integrated Desktop Management Interface (DMI)³
- EPA Energy Star certified
- Free three-year limited warranty for parts and labor²

HP Vectra XU

- Integrated 32-bit PCI SCSI-2 interface
- PCI integrated 64-bit S3 Vision-864 graphics with 1280 x 1024 resolution or PCI MGA Ultima Plus graphics with up to 1600 x 1200 resolution
- 32-bit PCI IDE hard disk interface
- 8 or 16 MB of RAM, expandable to 256 MB
- PCI Integrated 32-bit 10Base-T networking
- Integrated Desktop Management Interface (DMI)³
- Free three-year limited warranty for parts and labor²

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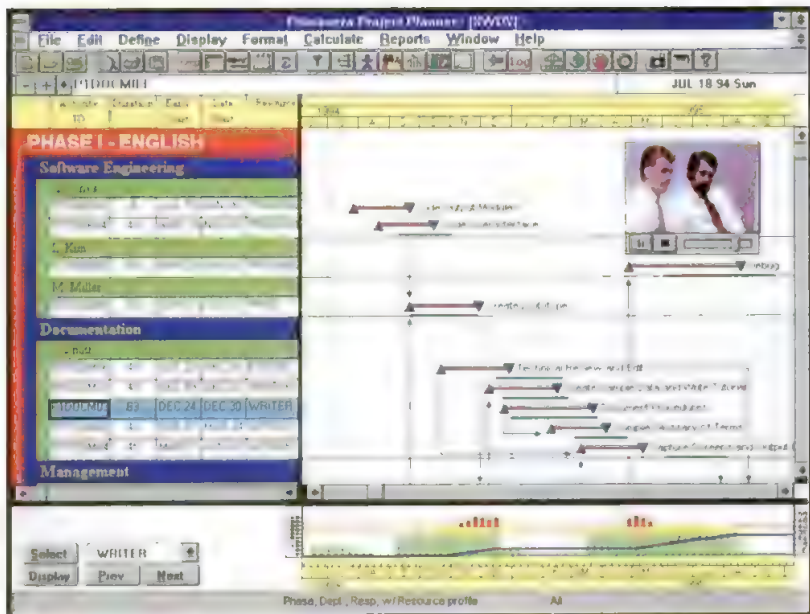
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All HP Vectra PCs come with MS-DOS[®] 6.2 and MS Windows for Workgroups 3.11 pre-installed; HP mouse and keyboard included. *Feature included with some models. ¹U.S. list price; dealer prices may vary. Monitor not included. ²Other capacities available. ³First year on-site, 24-hour service. Second and third year return to dealer. ⁴Available 10/1/94. ⁵With permission CRN/Benchmark. MS-DOS is a U.S. registered trademark and Windows is a trademark of Microsoft Corporation. Pentium and the Intel Inside logo are U.S. trademarks of Intel Corporation. PPG407 ©1994 Hewlett-Packard Company

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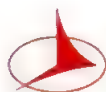
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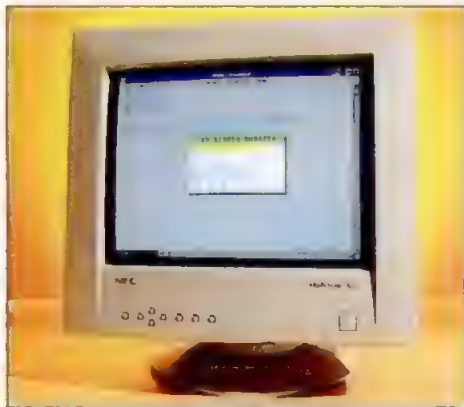
By Adam A. Hicks

NEW

NEC Puts Monitor Controls On-Screen

Originally introduced in 1985, **NEC Technology's** MultiSync monitor family name has been through many generations, the latest of which is the MultiSync X Series. NEC's new X Series consists of the low-end Enterprise line and the high-end Professional line for graphics power users. There are six new monitors, including a 15-inch, a 17-inch, and a 21-inch in each line.

The monitors share a wide array of design and performance features, including flat square screens with anti-static OptiClear surfaces and a dot pitch of 0.28 mm. The monitors are the first to support both the Plug and Play (PnP) and ACCESS.BUS specifications, which reduce the troubles you will have reconfiguring the monitor when you're changing cards and peripherals.



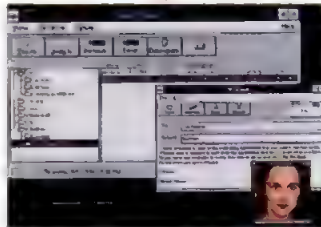
The on-screen management features in the NEC MultiSync X Series software look like the displays you see on a television.

You will also receive MonitorManager software with your monitor for managing resolution, color, and power-down settings (which are displayed from an on-screen manager visual interface).

► **MultiSync X Series.** Estimated selling price: *Enterprise line, \$575 to \$2,095; Professional line, \$695 to \$2,580.* NEC Technology Inc., Wood Dale, Illinois; 800-632-4636, 708-860-9500; fax, 708-860-5618.

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HOT
PROSPECT



Be the Sysop of Your Own On-Line Service with Filex BBS

Durand Communications Network's new bulletin board software, Filex BBS, lets you create a BBS of your own that has the look and feel of the large commercial on-line services. Whether you're creating your own for-profit on-line BBS service for an organization or for private business, this package will provide the BBS essentials to get you started.

Filex BBS is a client/server multi-user Windows bulletin board system with six different modules: accounting, chat, e-mail, file library, messaging, and security. There is also an interface builder for creating a customized graphical menuing system with built-in compressed images, as well as buttons with links to graphics for the host system. Users connect to the host using runtime client software that you can distribute royalty-free. Each feature of your BBS can be given a separate level of security, and all the activity of your subscribers can be recorded for billing using an audit trail that is formatted for transfer to a database program. The software supports up to eight lines per host PC and will also handle compressed image viewing (including .CMP, JPEG, and .PCX).

► **Filex BBS.** Prerelease price: 1 incoming line, \$398; 4 incoming lines, \$548; 8 incoming lines, \$748. Durand Communications Network Inc., Santa Barbara, California; 805-961-8700; fax, 805-961-8701.

Circle 401 on reader service card.

NEW

Time Saving Add-Ons Primed For Word 6.0

The **Prime Consulting Group** has customized Microsoft Word for many corporate users, and now you can purchase a collection of 12 of the most popularly requested features to add to your Word for Windows 6.0 package.

Prime 6 is available from the Prime Consulting Group's distributor, Advanced Support Group. You can purchase either a single license or a multiuser site license. The program works as an add-on that integrates into existing Word features. The spell-checker in Prime 6 will produce a single list of all the words you've misspelled for easy editing and also includes a word-frequency listing. Using the software, you can define more elaborate templates (including the ability to specify what directory a particular template should be stored in), manage and preview Bookmarks with the Bookmark Manager, and create icons for individual files for quick access. Other features include an AutoText Lister, Zoom control to 10 settings, and more flexible window management.

► **Prime 6.** List price: \$39.95. Prime Consulting Group Inc., Hermosa Beach, CA; 800-788-0787, 314-965-5630; fax, 314-966-1833.

Circle 403 on reader service card.

IMPROVED

High-End Accounting Software From Acropolis Adds Up

Modules are the building blocks of high-end accounting packages, and **Acropolis Software's** Acropolis for Windows, Version 3.0, adds three new bricks to the foundation. Two modules (Payroll and Bank Book) increase the functionality of the software, while a third, Import/Export Manager, increases your ability to easily exchange data among modules or other applications. The Payroll module is flexible enough to handle customized deduc-



Acropolis for Windows' Payroll module handles all types of employees.

New & Improved

tions, check printing, and W2 printing, as well as time-off and sick day tracking. You'll also be able to define characteristics of each employee, including appropriate tax tables and employee contributions to benefits or profit-sharing programs. The Bank Book module lets you see current totals as each transaction is recorded, with complete "drill-down" links to the associated records. Meanwhile, the Import/Export Manager will let you import invoices directly into the Accounts Receivable module and will also accommodate data feeds from mainframe or minicomputer systems.

► **Acropolis Accounting for Windows, Version 3.0.** List price: \$495 to \$995 per module; starter kit (includes General Ledger, System Manager, Chart of Accounts, Financial Reports, Bank Book, Accounts Receivable, and Accounts Payable modules), \$1,995. Acropolis Software Inc., Kirkland, Washington; 800-525-8700, 206-820-8700; fax, 206-820-4258.

Circle 404 on reader service card.

NEW

Swap Data Formats with Innovative's Conversion Software

OpenExchange database conversion software from **Innovative Solutions** may make the leap of faith between database religions a little bit easier. When it is necessary for you to transfer data between different data-storing applications, this Windows-based package could aid in the reformatting process to ensure that no data gets lost or ends up in the wrong format.

The OpenExchange software converts, formats, and updates database and spreadsheets in a variety of formats, including Access, Btrieve, dBASE, Excel, FoxPro, Paradox, SQL servers, and text files. After you link fields using the Windows drag-and-drop interface, you can select multiple files, ranges of files, or individual files to be imported or exported into another format.

The package will read and create ASCII files to be used for Electronic Data Interchange exchanges, as well as PC to SQL and PC to mainframe translations. You can also create conditional transfers for reformatting mailing lists, updating files from mobile users, and archiving data to other systems.

► **OpenExchange Standard Edition.** List price: \$89. **OpenExchange Professional Edition.** List price: \$189. **OpenExchange ODBC/SQL Edition.** List price: \$389. Innovative Solutions Inc., Joplin, Missouri; 417-781-3282; fax, 417-781-3299.

Circle 405 on reader service card.

BRIEFS

Software

Crosswise Corp.'s document conferencing software, Face to Face, Version 2.0, (\$179) is the first conferencing product that supports cross-platform communications. The new Listener portion is a receive-only version of the software that you can distribute free of charge for either Macintosh or Windows users. Other new features include expanded network support that now includes TCP/IP networks, a general-purpose file-transfer utility, and expanded modem support. 800-747-9060, 408-459-9060.

Austin-Hayne Corp., maker of Employee Appraiser 2.0 for Windows employee-evaluation-writing software, now include a Forms ToolKit with every version of the package. You can create custom forms or turn existing forms into electronic documents to give the package a more authentic look and feel. The Kit incorporates several components including support for company logos, ratings boxes, and employee development plans. The new package is available free if you already use Employee Appraiser 2.0 for Windows, which is priced at \$129. 800-809-9920, 415-610-6800.

Alumni Computer Group offers one of the most vertical applications on the market: PCLAWjr. The program, which is specifically designed for the administration of small to midsize law firms, just got even more specific. PCLAW Payroll for Windows and PCLAW Bank Reconciliation for Windows are accounting applications designed especially for the payroll and account management needs of a small to midsize law firm. The \$200 Payroll package offers you a choice of 50 user-definable earnings and deductions per employee, while the \$125 Bank Reconciliation module automatically calculates totals and generates reports of everything from bank transactions to interest payments and service charges. 800-387-9785, 416-292-0893

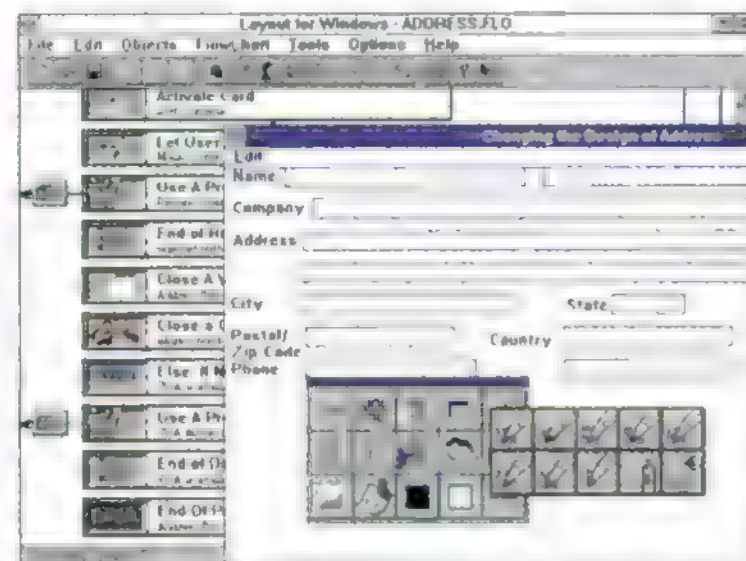
Envelope Manager Software has improved on its mailing-list management software. The new DAZzle Plus, Version 2.1 (\$79.95; upgrade from 2.0 of DAZzle, \$20; upgrade from DAZzle,

NEW

Development Software Sans Source Code Thanks to Layout

Four years ago, **Objects** created a successful development tool: Layout for DOS. Since then, nonprogrammers have taken command of code creation with Windows-based tools, which has made Rapid Application Development possible. To keep pace, Objects created Layout for Windows, which lets you take advantage of all of Windows's flexibility without having to see code.

Layout supports high-resolution graphics cards and 16-bit stereo sound cards, as well as TrueType, Adobe Type Manager, and PostScript Type 1 fonts for presentation quality WYSIWYG report printing. In addition to creating fully executable programs from scratch, the package lets you work with C and C++ code.



Rapid Application Development the Object way with Layout for Windows.

If you have existing .FLO files from Layout for DOS, you can import them to Layout for Windows to create a Windows program quickly. Developing in Windows lets you use drag-and-drop design tools to place OLE object links to other applications, including spreadsheets and full-motion video, and position DDE connections for real-time data updates to files.

► **Layout for Windows.** List price: \$299.95; upgrade from DOS 2.x version, \$149.95; upgrade from DOS 3.x version, \$129.95. Objects Inc., Danvers, Massachusetts; 800-424-6644, 508-777-2800; fax, 508-777-0180. Circle 406 on reader service card.

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Since CD-ROM disks store such large quantities of data, searching them efficiently requires an effective filing system. For stock photography, **Westlight Creative Ser-**

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Mike Henneberry, Henneberry Consulting

“dBASE has gone way beyond its competitors by making it a lot easier to create objects, develop customized reports, and work with existing DOS data.”

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▲ The promise of Rapid Application Development is fulfilled

You need a development environment that helps you get your job done fast. That environment is dBASE for Windows. Only dBASE for Windows provides the most complete set of productive tools and object-oriented extensions to the dBASE language to reduce development time. That includes unique Two-Way-Tools™ that let you work interchangeably between your visual design and dBASE source code. As you design forms, queries, and menus, dBASE for Windows automatically generates object-oriented dBASE code for you. You can edit the source code directly, and your changes are reflected instantly back in your visual design. As a result, you dramatically reduce the time required to develop Windows and Client/Server applications.

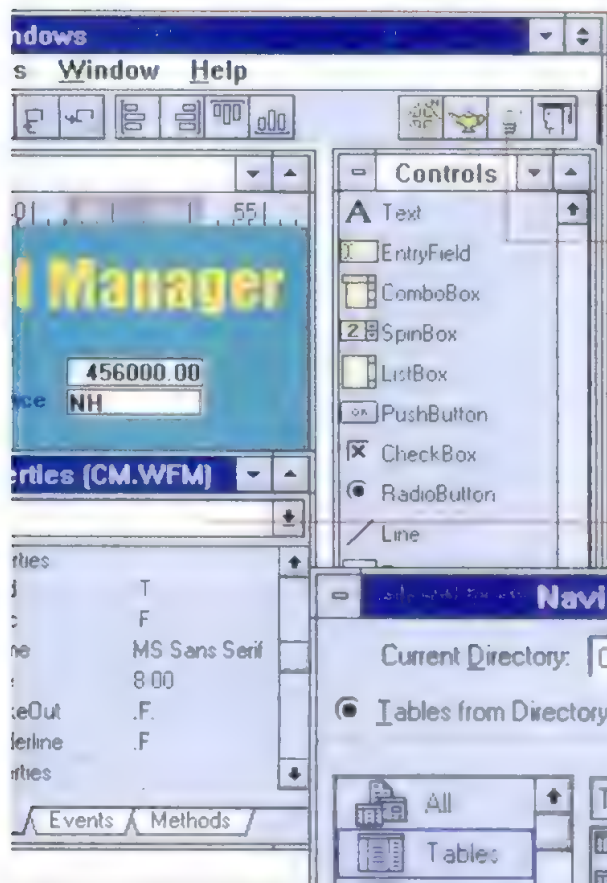
Only dBASE gives you everything you need to move to Windows and Client/Server in one step.



Build multi-table queries visually with the Query Designer. Use SpeedFilter technology to get results fast.

	dBASE	TextPro	Access	PowerBuilder
Compatibility with dBASE standard	Yes	No	No	No
Two-Way-Tools that resolve to code	Yes	No	No	No
Language supports full object model (OOP)	Yes	No	No	No
Full context-sensitive On-line Help	Yes	No	No	No
Experts/Wizards	Yes	Yes	Yes	No
Interactive Tutors work with "live" data	Yes	No	No	No
Design forms with "live" data	Yes	No	No	No
Property inspection tool	Yes	No	Yes	No
Automatic multi-table forms and reports	Yes	Yes	Yes	No
Custom control usage	DLL,VBX, dCC	No	OCX	DLL,VBX
Directly calls the Windows API	Yes	No	No	Yes
Optimized for complex and network queries	Yes	No	No	No
Transparent access to local and SQL data	Yes	No	No	No
Use dBASE language to SQL server	Yes	No	No	No

Windows database development



— Learn dBASE
easily with
Interactive Tutors

Create stunning forms
automatically with
the FormExpert™

The Object Inspector
lets you modify
reusable objects with
a click of the mouse

The dBASE
Navigator gives
you easy access
to local or SQL
tables, queries,
forms, reports,
applications,
and more



dBASE for Windows makes object-oriented development easy

You may have heard that object-oriented programming is difficult to learn. Not anymore.

One of the biggest breakthroughs is that dBASE for Windows makes it easy to learn object-oriented development. The Two-Way-Tools generate object-oriented code, so you learn object-oriented programming by simply using the visual designer.

dBASE for Windows also includes built-in objects that are ready to go. All the properties and procedures that define the object are already built for you. You can use Borland's unique Object Inspector® to instantly modify these reusable objects just by pointing and clicking with the mouse. Since you're working with proven, prebuilt components, you develop faster and create new applications that are more reliable, and more easily maintained. There's simply no better way to build Windows and Client/Server database applications.



1-800-336-6464, ext. 8939

Borland
The Upsizing Company



dBASE for Windows

● Open "Plug-and-Play" Architecture

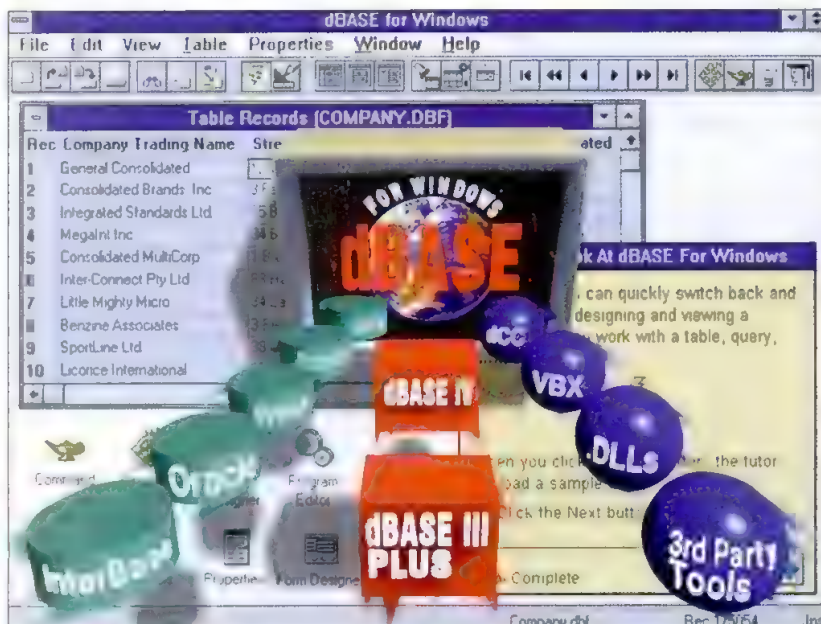
opens a world of opportunity

dBASE® for Windows is architected to allow you to "plug in" a full array of components to extend the power and functionality of your applications. Incorporate any kind of information—

data, sound, graphics, video, even entire applications as Object Linking and Embedding (OLE) objects. And with full access to the Windows API and the ability to call Windows

.DLLs, dBASE for Windows gives you incredible flexibility to mold the Windows interface to suit *your* design.

If you have VBX or other third-party controls, you can use them just like built-in objects in dBASE. Or you can create your own custom controls in the dBASE language. Once you plug them into dBASE, they work just like native controls. It all means that now dBASE developers can instantly plug in and add virtually any kind of functionality to their applications—spreadsheet, communications, graphics, you name it!



◀ With dBASE for Windows, you can plug in virtually any component, access local data and remote SQL data and leverage your dBASE for DOS knowledge to build great Windows applications in record time.

▲ Unmatched compatibility

fully leverages your investment in dBASE for DOS

If you have ever used dBASE, new dBASE for Windows will be the most comfortable and productive way to create and use database applications for Windows. Whether you want to create stunning forms and reports, or use information stored in remote databases, only dBASE for Windows gives you the tools you need...using knowledge you already have. Your investment is secure because programs created in dBASE for DOS can run in dBASE for Windows. You can even

use the new Component Builder™ to give your existing applications a new graphical look. And dBASE for Windows and dBASE for DOS can be run concurrently by different users on a network. Only dBASE for Windows can offer you this kind of effortless compatibility with dBASE for DOS.

Borland even offers a new version, dBASE 5.0 for DOS, for users who need to continue to support and extend their investment in DOS.

Also Available:
New version dBASE 5.0 for DOS

All the power and functionality of dBASE IV, plus:

- Twice the performance of dBASE IV® v 2.0
- Developer's Desktop Integrated Development Environment (IDE)
- Integrated .EXE Compiler
- Two-Way-Tools that read and write source code
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New visual tools for managing data *gets your work done fast*

dBASE for Windows takes full advantage of Windows. You can perform virtually any operation you want just by pointing and clicking with your mouse. The dBASE Navigator and Catalog Window let you view, organize, and access all your tables, queries, forms, reports, labels, programs, and related files. The new Visual Query Designer with SpeedFilter™ technology returns

answers fast, even when you're searching multiple tables. The FormExpert™ creates great-looking forms for you. And with SpeedMenus,™ Object Inspectors,® Interactive Tutors™ and On-line Help, you'll be up and running, and seeing productivity gains right away.



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* Available second half 1994

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CIRCLE 220 ON READER SERVICE CARD

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Borland The Upsizing Company

New & Improved

vices has developed the Questock Image Search System, a CD-ROM-based catalog that contains several thousand images from Westlight's 2-million-strong image library. The most impressive thing about the CD is not the wide selection of photographs available for purchase but the extensive indexing of the images, which gives you hundreds of thousands of locators to find an appropriate image. Instead of searching through photo and clip-art catalogs manually, you can search for a match based on colors, shapes, moods, or on the content of the image you need. A single image may have over 100 indexed characteristics, for example, and you can search for it by agency, dominant color, environment, light angles, mood, and concepts.

The CD-ROM will run on a Macintosh or a PC and also works using the CD-I, 3DO, and Kodak disk-playing systems. All images are available for licensing from Westlight in slides or high-resolution Photo CD files.

► **Questock Image Search System.** List price: \$59.95. Westlight Creative Services, Los Angeles; 800-622-2028, 310-820-7077; fax, 310-820-2687.

Circle 407 on reader service card.

NEW

Turn Your Hard Disk into a CD-ROM Recording Master

Formatting data for publishing on a CD-ROM requires a writable CD-ROM drive, but with the Master CD CD-ROM recording drive from **MicroNet Technology**, you can publish to CD from within a PC. MicroNet, known primarily for its RAID systems (such as the Raven Disk Array series) is now producing a software/hardware combination external CD-recorder for mastering CD-ROMS from your hard drive. Currently available for EISA, ISA, Micro Channel, and VESA VL-Bus adapters (a PCI version is scheduled to be available by the time you read this), the unit will create a CD in many different data formats including Apple HFS, CD-DA (audio recording), CD-XA, Photo-CD, CDI, ISO 9660, Hi-Sierra, and multitasking applications. The unit comes with Windows software that includes EZ Edit (which lets you edit the CD image without creating a separate partition) and a performance simulator to see how your CD-ROM will function before you write to the CD-ROM disk. Once you're ready to publish, there is a 1.2MB cache for faster transfers—up to 8.5MB per minute, according to MicroNet.

► **Master CD.** List price: \$2,495. MicroNet Technology Inc., Irvine, California; 714-453-6100; fax, 714-453-6001.

Circle 408 on reader service card.

BRIEFS

Software

\$40), now reads dBASE and Windows Card files and supports DDE links to other Windows programs (including integration into Symantec's ACT!) for batch printing. Also new is a Dial-A-ZIP function, which will use your modem to call the U.S. Postal Service's AMS ZIP+4 directory for a group of addresses free of charge. 800-576-3279, 415-321-2640

Great Bear Technology integrates the New American Library Reference Set into one \$49.95 software package that you can access from a toolbar located within word processing applications such as Ami Pro, Microsoft Word, and Word Perfect. ReferenZing includes a Windows-based dictionary (The New American Handy College Webster Dictionary), thesaurus (Roget's College Thesaurus), and encyclopedia (The New American Desk Encyclopedia). You can find facts and check spelling or search for terms using one of six different word searches, including partial word, rhymes, cross-words, and anagrams. The package requires between 5MB and 14MB of hard disk space. 800-795-4325, 510-631-1600

Microsoft Corp. has also decided to update the reference tools it offers with the new Microsoft Office Professional & Bookshelf and Microsoft Word & Bookshelf CD-ROM versions of its popular software suite and word processing package. Both packages are distributed on CD-ROM and contain all the Bookshelf reference tools (which will require 84MB of disk space for full installation). Bookshelf includes The American Heritage Dictionary, Third Edition; Roget's Original Thesaurus of Words and Phrases; The Columbia Dictionary of Quotations; The People's Chronology; The Concise Columbia Encyclopedia; Hammond Intermediate World Atlas; and World Almanac and Book of Facts 1994. In the \$599 suite version all aspects of the suite and Bookshelf products are accessible from the Microsoft Office Manager. The version of Word with Bookshelf is priced at \$399. 800-426-9400, 206-882-8080.

NEW

Stealth PCs from Silent Systems

Pushing the PC even further into commodity status, it is now possible to judge a PC based upon the amount of noise it makes. In the case of **Silent Systems'** new PC, the noise caused by fans, disk accessing, and other operations has been reduced from approximately 44 decibels to less than 24 decibels. Silent Systems are high-end personal systems that combine easy to upgrade modularity with an architecture that promotes maximum cooling silently. Rather than putting in large fans to blow heat out of the system, the FE4 has several small fans strategically placed and is designed to allow cool air to flow over the parts that get hottest. In addition to this different



The 24 decibels the FE4 emits are inaudible.

method of cooling, the hard disk is encased to reduce noise generated from disk accesses. You will also find the design to be completely modular, making future upgrades and replacements that much easier to accomplish. The base systems are 486DX/33's with

212MB hard disks, 15-inch monitors, 8MB of RAM, and a 256K cache, but you can get upgrades that include a 486DX2/66 chip, a 420MB hard disk, or a 14.4-Kbps internal modem.

► **Silent Systems Model FE4.** List price: Standard configuration, \$2,450. Silent Systems Inc., Burlington, Massachusetts; 800-745-3689, 617-273-3200; fax, 617-273-0500.

Circle 409 on reader service card.

NEW

Trumatch Colors Live Up To the Name

Trumatch lets you see how your color printer will print any of the Trumatch System of colors for on-the-fly color printing. Now that more people have color printers, service bureaus may not always be used for production of presentation materials. Therefore, matching four-color processed swatches will not tell you what colors will look like when you print on the fly from your color printer. Whether you're using an expensive laser printer or a simple ink jet, the

Photograph by Jeff Krein

New & Improved

SwatchPrinter software will create a reference book of all Trumatch colors in the fanguides, a single color group, or a collection of color groups of swatches that will reflect the exact color that your printer will output.

► **SwatchPrinter Software for Windows.** List price: *Software only, \$48; with Colorfinder fanguide coated-paper edition, \$113.* Trumatch Inc., New York; 212-302-9100; fax, 212-302-0890.

Circle 410 on reader service card.

NEW

Get Audiences to Stand Up and Cheer with New Proxima LCD

The new Ovation+ line of LCD panels from **Proxima Corp.**, a leader in LCD projection panels, is targeted for people who are doing presentations for large audiences and who need the best image quality. Keeping the attention of large groups is difficult enough, so you shouldn't have the added hindrance of small, poor-quality displays. The series contains three models: the 840 (an 8.4-inch screen), the 842 (also an 8.4-inch screen, which is adequate for audiences up to 50), and the 846 (a 9.4-inch screen that is better suited for audiences up to 200 people). The 840 model is for data-only presentations; the 842 and the 846 will also handle your multimedia needs. All three models offer 16.7 million colors with up to 800-by-600 pixel resolution. The Ovation+ line includes improvements over the standard Ovation line, such as its inclusion of two stereo audio sources, its compatibility with the Cyclops 2050 remote-control pointing system, its light board feature for hand-writing annotations directly on the screen, and a graphical user interface to drive the systems.

► **Ovation+ line of LCD panels.** List price: \$4,995 to \$6,695. Proxima Corp., San Diego; 800-447-7694, 619-457-5500; fax, 619-457-9647.

Circle 411 on reader service card.

IMPROVED

Drafix CAD Professional High-End Drafting Package

As high-end computer-aided design (CAD) packages go after greater market share with scaled down versions, low-end CAD packages are adding more powerful features to differentiate themselves from the pack.

After ten years in business, **Foresight Resources** may be better known for its Planix Visual Office and Planix home business

BRIEFS

Hardware

OmniLabs announced its new 16-bit sound card with 48k sampling, WaveTable/FM Synthesis, and 2MB of MIDI WaveTable samples in ROM. The \$199 card, the AudioMaster 32, can be upgraded with more memory and can control up to two joysticks using its MIDI/Joystick port. The card includes both an on-board stereo 4 Watt power amplifier and a line level audio out feature. You'll also be able to add an optional effects processor module (\$49) to add effects such as reverberation and echo. 800-706-3342, 415-512-2638.

Labtec Enterprises will also help your system sing out loud with its new CS-600 computer speakers (\$59.95). The CS-600 concentrates all its external controls for volume, dynamic bass, treble boost, and power on one speaker for easy access. Now you'll also find a front-mounted headphone jack for more personal listening experiences., 206-896-2000

Microplex Systems Ltd. has put PCMCIA technology to work in its new M204 print server. Pricing starts at \$595 for this multiport, multiprotocol print server with dual Type II PCMCIA slots. The first M204 supports both Ethernet and Token-Ring cards, has four ports, and can handle up to 256 print queues. The product features a load-balancing software that determines the shortest queue for your print job to wait in and keeps track of printer usage and errors for network reporting via back channeling, SNMP, and SMTP e-mail. The unit supports TCP/IP, IPX/SPX, AppleTalk, and NetBIOS tunneling over TCP/IP for compatibility with many platforms. 800-665-7798, 604-444-4232.

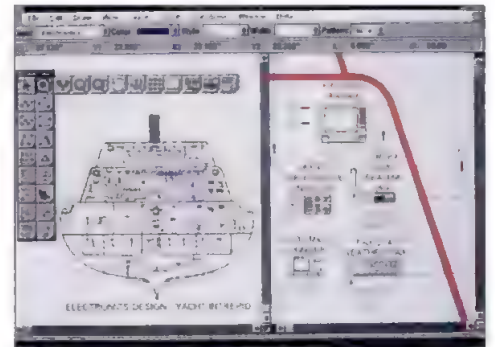
KYE International Corp. has joined in the race for graphic arts pads. The new \$149 EasyPainter is a graphics drawing tablet with a 5- by 5-inch drawing area. The pen is connected via a cord, which is not as much fun as the cordless kinds, such as the ArtPad from Wacom. The unit is bundled with SoftKey's PC Paintbrush and can be used either as a drawing device or a mouse alternative.

planning and home planning CAD software. Its latest product is a new version of Drafix CAD for Windows called Drafix CAD Professional, Version 3.0. There are 100 new features in this version.

The Drafix CAD Professional package is compatible with AutoCAD .DWG files and includes a library of 5,000 different symbols along with hundreds of sample drawings on a CD-ROM. Other Drafix CAD Professional features that lean towards high-end packages include OLE 1.0 server support, Multiple Document Interface, and an enhanced macro language called MacroPro to program the package.

► **Drafix CAD Professional, Version 3.0.** List price: \$495. Foresight Resources Corp., Kansas City, Missouri; 800-231-8574, 816-891-1040; fax, 816-891-8018.

Circle 412 on reader service card.



Drafix CAD Professional: A low-end package adds high-end features to enter new markets.

NEW

Antec Broadcasts PC Images Over the Television Screen

You may already own that large color monitor you're thinking of buying: Your TV can display PC images using a PC-to-TV scan converter. **Antec** offers the TVator Remote, a plug-and-play unit that works with PCs and Macintoshes and displays all the popular television standards. The 13-ounce unit, which is compatible with all VGA video cards, connects to the PC via a 15-pin VGA mini D-sub female connector and accepts analog RGB signals at horizontal frequencies of 24 kHz to 35 kHz and vertical frequency of 50 kHz to 70 kHz, and maximum resolutions of 800 by 600. With the TVator Remote you can output to NTSC (American), PAL (European), SVHS (composite video), and RGB signals.

► **TVator Remote.** List price: \$499. Antec Inc., Fremont, California; 510-770-1200; fax, 510-770-1288.

Circle 413 on reader service card.

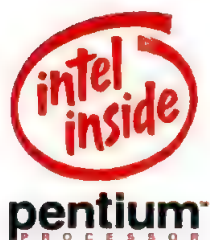


386-based PCs



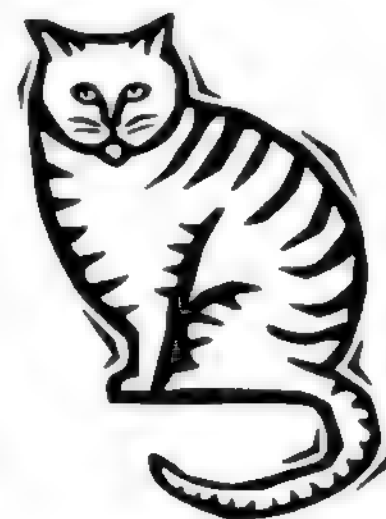
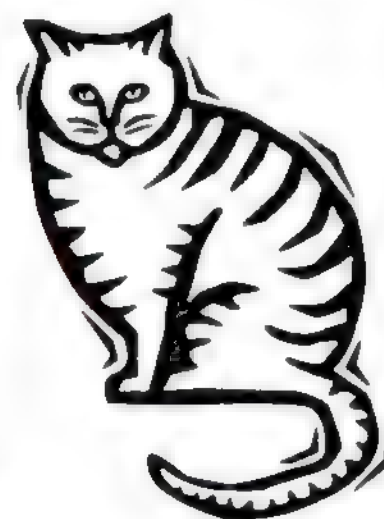
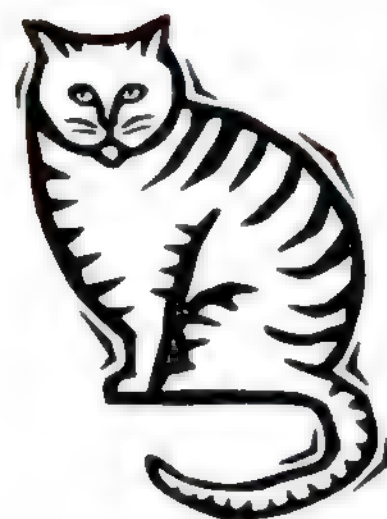
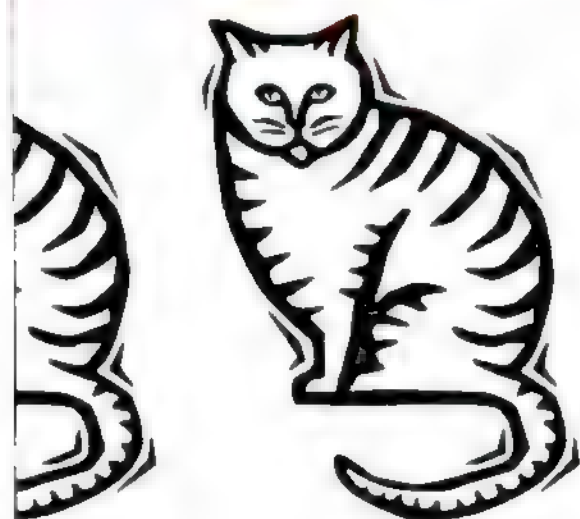
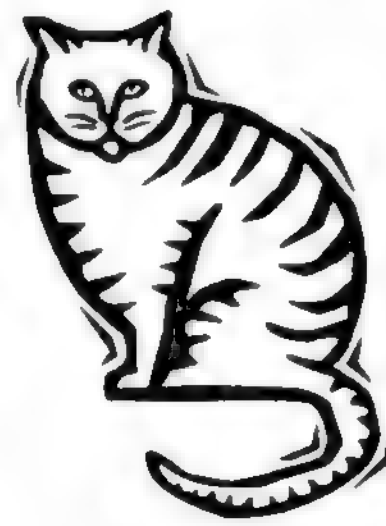
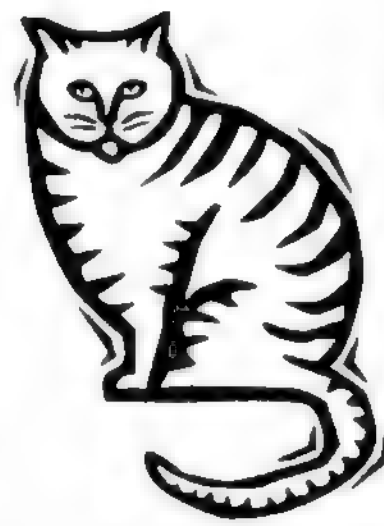
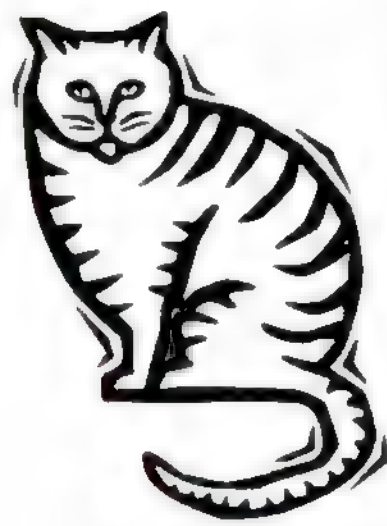
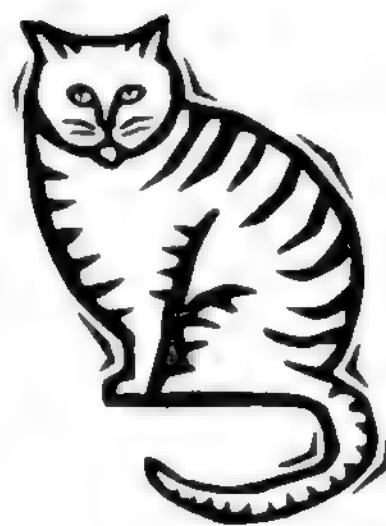
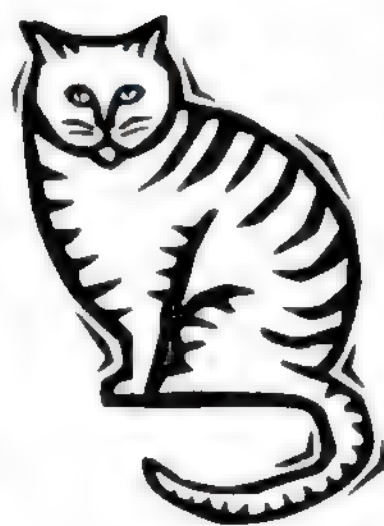
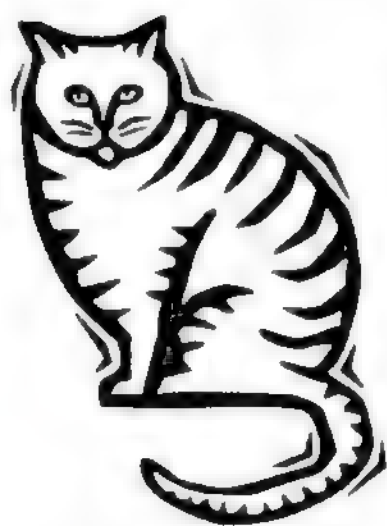
486-based PCs

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Pentium™ processor-based PCs

rs have nine lives.

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you'll be getting a system that performs so well. Today. And several lives from now. For more information call 1-800-626-6788, Ext. 213.

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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Tin Albano

Programming the Iron

BY SHERYL CANTER

The Undocumented PC: A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas, by Frank Van Guilleuwe, is a bible for system-level programmers and fascinating reading for anyone with a technical background who wants to understand how the PC really works. This book is a treasure trove of hard-to-obtain information, with comprehensive listings of functions, ports, and data locations—many never before published. It also offers unusually detailed and comprehensive descriptions of how the major subsystems operate. For example, the chapter on DMA (direct memory access) provides the first lucid and technically complete discussion of this topic I've seen anywhere.

Scrupulously researched, *The Undocumented PC* is an outgrowth of information gathered over the last eight years for use in a program called Sourcer, a disassembler written by Van Guilleuwe that converts executable files and BIOS ROM into assembly code.

The information in *The Undocumented PC* was obtained by going directly to original sources. Van Guilleuwe reviewed IC (integrated circuit) data sheets, examined the schematics of how chips connected to motherboards, disassembled BIOS listings, created test programs, and read the official documentation. A disk included with the book contains source code and executables for the dozens of sample

programs and utilities used to demonstrate points in the book.

Often hardware manufacturers leave functions undocumented because they are for internal use and subject to unpredictable change from version to version. For example, the LOADALL command exists on the 286, 386, and 486 for system testing, but works differently on each chip. The chapter on system and equipment detection provides a program that checks whether a particular undocumented function exists on a system. Another program searches for new, undocumented functions.

The chapter on adapter card development starts with a detailed explanation of how the BIOS power-on self-test scans memory, and goes on to analyze



Read Only Recommends

Ian Oliver's *Programming Classics: Implementing the World's Best Algorithms* is a fantastic addition to any programmer's library. Oliver's book details an abundance of problem-solving algorithms originally developed by some of the world's most famous programmers. \$38; Prentice Hall, 515-284-6751; ISBN: 0-13-100413-1.

the best ways to obtain necessary RAM. The discussion of system timers goes beyond a description of different modes of operation to detail the limitations imposed by the motherboard, describing what is actually—versus theoretically—possible. A chapter on interrupt control describes how to redirect hardware interrupts to increase speed and avoid conflicts.

In these days of advanced operating systems, few programmers write to the hardware anymore; well-behaved programs must go through the operating system API (application programming interface) to insure compatibility. But systems pro-

grammers—those creating the software that mediates between hardware and applications software—still need to know what's going on at the lowest level of detail. If you're a systems programmer, *The Undocumented PC* belongs on your bookshelf.

You can download the first chapter of this book on the Web at <http://dab.psi.net/Chapter-One/PCMagazine>.

► **The Undocumented PC: A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas**, by Frank Van Guilleuwe, \$44.95; Addison-Wesley Publishing, 617-944-3700. ISBN: 0-0201-62277-7.

Circle 451 on reader service card

Access Accessories

BY DAN SMITH

Microsoft's database management system, Access for Windows 2.0, is an efficient time-saving tool but it can be intimidating. Two books from Microsoft Press, *Microsoft Access 2 for Windows Step by Step* and *Running Microsoft Access 2 for Windows*, are fear-alleviating guides.

Step by Step is an ideal book for novice users. It teaches you how to build a database quickly using forms, queries, reports, and expres-

sions. Guides for using the expression builder are discussed but issues such as building macros and functions are not.

Running Microsoft Access 2 is designed for intermedi-

ate users

who are interested in building slightly more complex databases. This easy-to-read book includes extensive diagrams, undocumented tips, and solutions geared toward making a

more efficient database. Detailed examples on building functions and macros are also included.

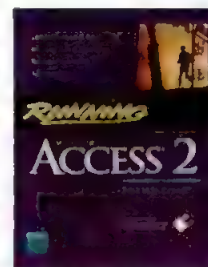
Running Microsoft Access 2 also serves as a handy reference book. Each chapter is so well structured that a reader can easily find out how to execute a particular task.

► **Microsoft Access 2 for Windows Step by Step**, \$29.95; Microsoft Press, 800-677-7377. ISBN: 1-55615-593-X.

Circle 453 on reader service card

► **Running Microsoft Access 2 for Windows**, \$39.95; Microsoft Press, 800-677-7377. ISBN: 1-55615-592-1.

Circle 454 on reader service card





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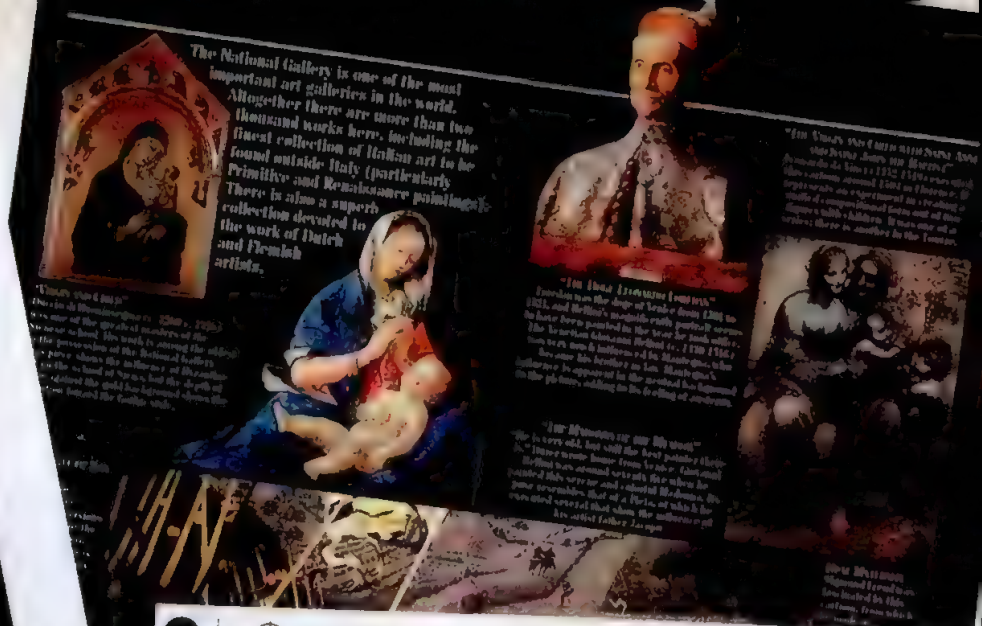
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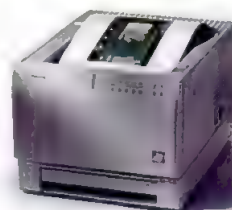
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Michael J. Miller

Origins of PC Species

While visiting a number of PC manufacturers recently, I was struck by the wide variety of approaches that these companies take toward producing their machines. The differences among the ways these companies work say a lot about the kinds

of products they make; in fact, the products often take on the personalities of the companies. But one thing is for sure: None of these companies are really taking a technology leadership role.

PC makers come in all shapes and sizes, ranging from companies with a couple dozen employees putting together computers in rented warehouses to international conglomerates pulling in billions of dollars in annual revenues. When we scrutinize these companies at *PC Magazine*, often we find little correlation between the size of the company and the quality of the machine. Some big companies make wonderful PCs, but so do some focused smaller companies.

THE MOVERS

On one end of the spectrum you have companies such as Dell, Gateway 2000, and ZEOS that focus on direct-response advertising. They specialize in building machines to order, often single units for single individuals. Direct-market vendors score high points by delivering great products at competitive prices, but they're not always the most innovative manufacturers around.

As a result, these vendors spend a lot of time worrying about *procurement*—getting the best components at the lowest prices. Their relationships with the manufacturers of processors, chip sets, hard disks, video controllers, and memory are key because these relationships give the vendors access to the components they need to build their products. These relationships also determine the cost of goods for the machines and the quality level of the components.

Like any manufacturer, however, all direct-market vendors face trade-offs among price, features, and performance. How they

make these decisions is what gives each direct-market vendor its individual characteristics. Some focus more on keeping their overhead charges low so they have as little inventory as possible. You might have to wait a bit longer to get your PC, but the price will be great. Others focus on convenience, building machines to order and delivering them quickly. Still others make sure they always offer the best performance and features. You can see decisions like these being made just by watching the way direct-market vendors' ads change on a monthly basis.

THE MAKERS

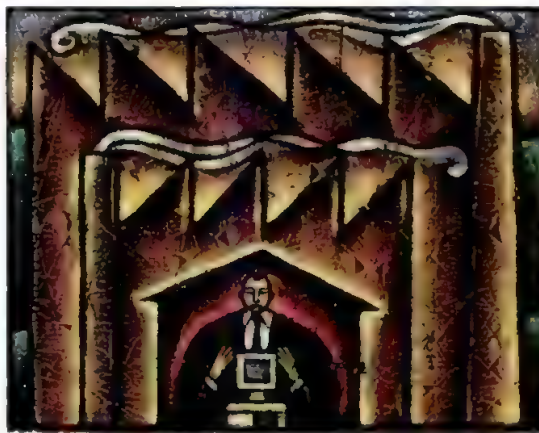
Another group of vendors, typified by AST and Compaq, focus tightly on making PCs, building them in bulk rather than one at a time. Because these vendors sell to retail outlets in large quantities, they try to make huge numbers of identical machines instead of taking the one-at-a-time approach of direct-market vendors.

As with the direct-market vendors, their relationships with their suppliers are important, but they also spend a lot of time focusing on efficient manufacturing and on reducing the number of defects, since defects translate into returned products. In desktop computers, these ven-

dors tend not to be the first to produce the highest levels of technology because they first have to create inventory and sell from that. They vary in the speed at which they choose to adopt new technology and in the way they package, configure, and create products designed for different customers in different retail environments.

THE SHAKERS

Then there are the big vendors—IBM, AT&T, and Hewlett-Packard—for which PCs are just one part of their business. These companies have large research and development arms and



There are three different ways to market a PC, and each method has distinct advantages for PC shoppers.

Michael J. Miller

often create a lot of new technology. Typically these companies make high-quality machines but don't tend to be first to market with technologies they didn't create.

Although you may find many similar components in PCs from each of these vendor types, the PC itself often reflects the personality of the company that makes it. The fast, direct-market vendors do tend to create fast, built-to-order machines; the companies that focus on manufacturing and reliability do tend to build solid, dependable machines, and so on.

Of course, these three descriptions—companies that focus on assembling components, those that worry most about manufacturing, and those that have both large amounts of R & D and broader product lines—are slightly stereotypical. We are seeing some broad companies focus more on manufacturing expertise and some of the companies that primarily focus on manufacturing perform significant R & D.

There is still a gap in the market as I see it, though. In the past few years, most PC

vendors have innovated in manufacturing and marketing, not in technology. One set of PC vendors have innovated in manufacturing techniques, focused on producing high-end products quickly. Another set have focused on software that differentiates their products, such as the ease-of-use front ends sold with AST, Compaq, and Packard Bell computers, or the new telephony products offered as part of the AT&T entries.

But where is the underlying innovation in technology? You'd be hard-pressed to point to any major breakthrough in desktop PC technology that you can directly attribute to a PC vendor.

Instead, technological innovation has come from the component vendors. Look at processors, hard disks, and graphics adapters: All have become a lot more powerful in the past few years, but little of this innovation came from the PC vendors. The basic PC is getting new features, like sound and a CD-ROM drive—but that push came from the vendors of those subsystems. Even fundamental changes like the PCI bus and Plug and Play technology are being driven primarily by Intel and Microsoft. These are good steps, but I can't help thinking that the basic desktop PC design hasn't come far enough.

Does it matter that these innovations come from PC vendors instead of component manufacturers? I think so. Look at the notebook PC market, where vendors like IBM, Toshiba, and Compaq have come up with innovations, often by working closely with the component suppliers. As a result, it's easier to see differences among notebook computers than among desktops. This has allowed the notebook market to change faster, and for us to get better products more quickly than we would have if the notebook makers had left the basic design alone and let the component manufacturers improve their individual pieces.

Clearly, the component makers of CPUs, hard disks, graphics boards, memory, and software have a lot to contribute to the future evolution of the PC. But just as clearly, we need something more than faster, bigger, and lighter components.

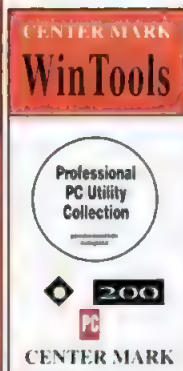
Somehow, this gap must be bridged. If not by the big, broad computer vendors, then maybe by those focused on manufacturing. If not by that group, perhaps by the direct-market guys. We need PC vendors to take on more responsibility for advancing the technology while leaving room for flexibility and competition. The question is, Will any PC vendor step forward to bridge this gap? □

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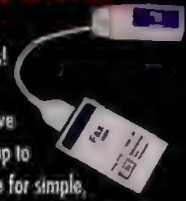
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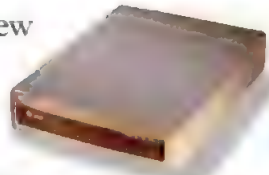


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Bill Machrone

A PC for the Home

Ever since pundits first described the joys and wonders of interactive television, I've been saying "It isn't going to happen" loudly and repeatedly. We've seen the market's lack of acceptance of several TV-oriented technologies, notably Philips'

CD-I and 3DO. I won't call them out-and-out failures, but sales figures speak for themselves, and a resounding lack of titles is eloquent condemnation. Such machines simply cost too much and do too little for all but the most dedicated fans. At the same time, Nintendo and, most notably, Sega have gone ahead with dedicated game machines. Game decks are simple and cheap, which is more important to consumers than game quality. 3DO was a bet that consumers wanted better graphics and more sophisticated games. CD-I was much the same, but emphasized educational titles.

I'd like to see the industry make another bet, one that would marry PC technology with the TV. The compelling reason to do it is software. The huge library of software includes games and graphics titles that are suitable to television's softer, lower-resolution image. The big screen makes games more compelling, too.

In previous columns, I put forth the theory that TV is passive and a PC active. In truth, that's oversimplifying. A computer and a TV are in different rooms for good reasons. First and foremost, TV steals time in half-hour seductions, while work (or play) done at a PC demands concentration and doesn't live by a program schedule. Other factors include the realities of interior decorating—most people don't put a desk in the living room. There's also the matter of a second TV set, either in the bedroom or the kitchen. Neither location is hospitable for a PC.

As the games get more complex and the graphical content on the computer gets more TV-like, some degree of merger is inevitable. Nintendo and Sega are ample proof that people play games on their television sets, yet the PC has all the good software. Unlike cartridge-based games, PC software is open-

ended. For instance, id Software, the publisher of DOOM, makes a program that lets you create your own DOOM worlds and adversaries. One of the editors here at Ziff-Davis has created a DOOMscape of our One Park Avenue headquarters—how's that for scary?! DOOM, by the way, is one of the applications that translates very nicely to television.

Many other graphically oriented packages play well on TV. For instance, Knowledge Adventure's entire Knowledge Adventure Interactive Books series uses big, bold graphics; large, readable type; and an oversize cursor. Even the somewhat delicate shadings of 3-D Body Adventure show up reasonably well on the big screen. Some of the encyclopedia programs have small type that's all but unreadable on TV, but most of the products use larger, bolder fonts than do run-of-the-mill Windows programs.

PC technology has driven the price of the components down to the point where a high-performance computer tailored to the TV-oriented consumer can live comfortably next to the TV set. Here's my proposal for a TV-oriented PC:

1. Make it look like a VCR. A power button, a floppy disk slot, and a CD slot are all you'd see on the front panel. Keep the appearance consistent with consumer audio/video gear. Put the other stuff, such as a volume control and an input jack for a digital camera, behind a door. Oh, yes: no disk caddy. Use a drawer-type mechanism, as with audio CD players.

2. Pack it full of features. Give it a fast 486 or a slow Pentium, 8MB RAM, 2MB of video RAM, 500MB of hard disk space, and Sound Blaster-compatible audio. Build in VGA-to-NTSC.

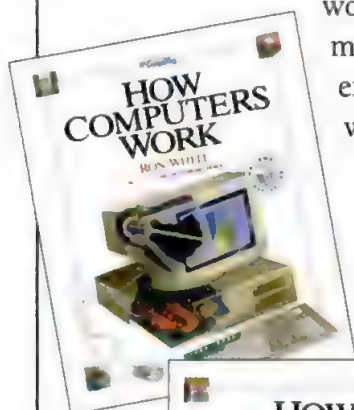
3. Keep the back panel simple. Left- and right-



The perfect TV-oriented home PC hasn't been invented yet, so I've designed one.

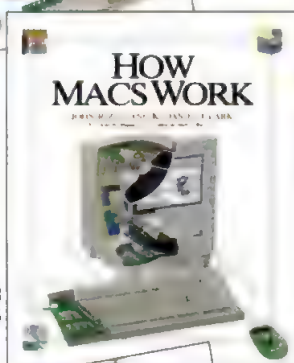
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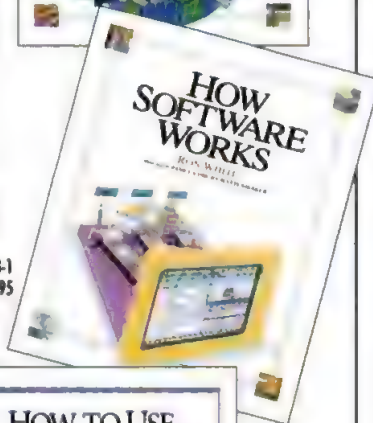
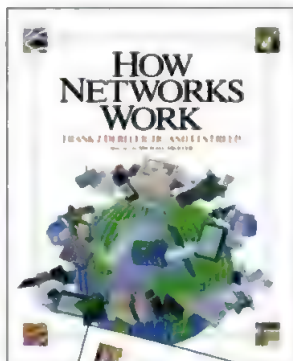


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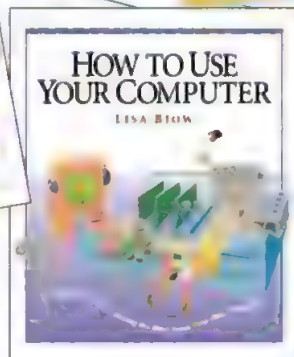


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channel RCA jacks for audio, a video connector, and a parallel port will suffice.

4. Offer minimal options. An upgrade to 16MB of RAM, an optional serial port/modem for networked or multiplayer games, and a MIDI wavetable synthesis board should do the trick.

5. Make the keyboard wireless. Use a laptop-style keyboard with a built-in pointing device. It should be RF-wireless rather than infrared so the family dog doesn't get in the way. The keyboard will need some kind of docking arrangement to recharge the battery, too.

The ultimate challenge is to get this down under \$500. That's not possible this year or next year, but it's achievable in 1996. Big hard disks today can cost as little as 50 cents per megabyte, and that price will go lower still. Even the PC's enormous library of available software won't get this machine hooked up to the TV unless it's very affordable. Price and the availability of inexpensive consumer titles are the gating factors.

FAMILY SLIDE SHOWS

The VCR-like PC, in turn, is the gating technology for the wide acceptance of other technologies. Chief among those is Photo CD. Kodak's groundbreaking technology is limited by several things: CD-ROM readers are not ubiquitous, computer screens tend to be small, and the home PC isn't located in places where you'd typically share family photographs. Using the family TV as a display device makes pictures a shared, fun activity, with none of the inconvenience of getting out the slide projector, setting up the screen, closing the blinds, and darkening the room. Using a PC rather than a dedicated playback device means that you can customize your presentations and build slide shows.

Wider acceptance of Photo CD, in turn, presages the wider use of digital cameras, hand-held or tabletop photo scanners, and ink jet printers for hard-copy output. These devices are available today, but they tend not to be consumer-friendly.

Movies are the one application I'm not looking forward to on the PC-VCR. I frankly think that the quality of films compressed to within an inch of their lives in order to cram them onto a CD is too low for all but the most uncritical viewer, and the uncritical viewer is not likely to be the customer for this product. □



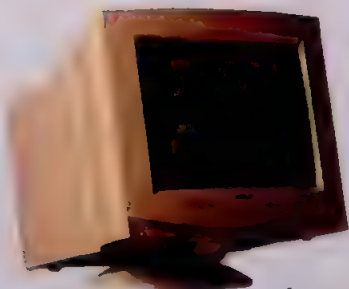
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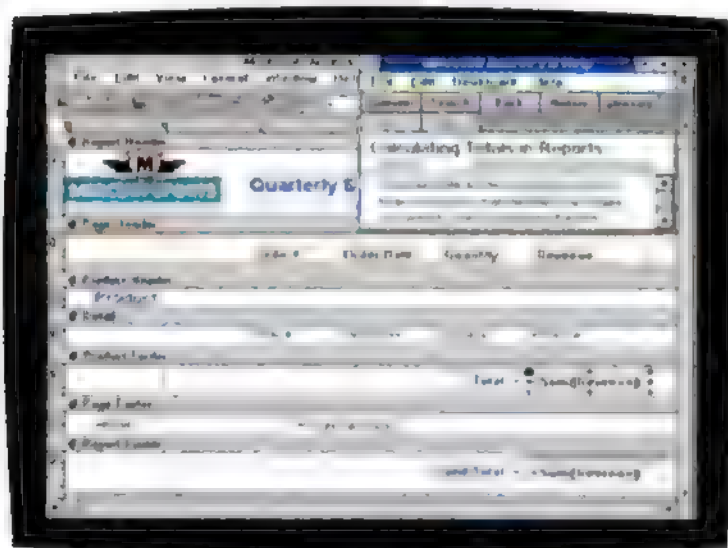
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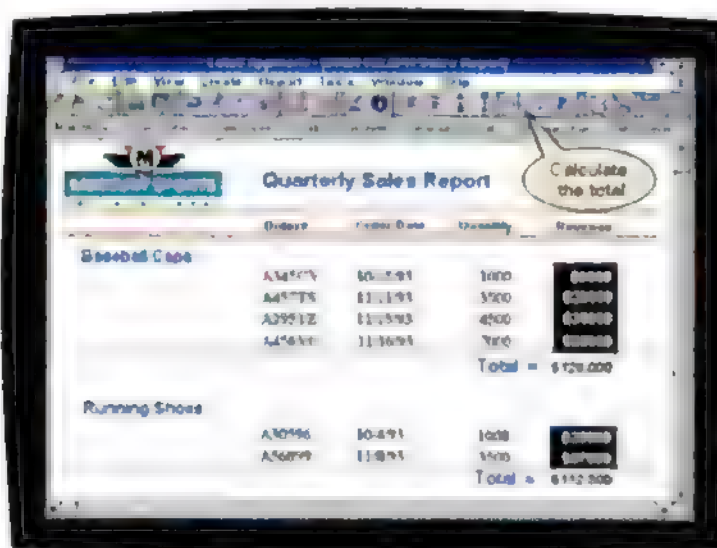
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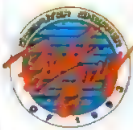
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John C. Dvorak

Blow Their Heads Off!

As I watched my nine-year-old blow the head off a fireball-tossing mutant in id Software's computer game DOOM, I considered the issue of violence in computer games and the mania to rate games. I have mixed feelings about sick and gratuitous

violence in computer games. Somehow, DOOM is different. Or is it?

In many ways, DOOM may be the most violent computer game ever written. The people and things you kill make a sickening groan as blood splashes all over the place. You can even use a chain saw to ravage the enemy, chopping him into a mess of blood and guts. DOOM is just a game, and the blood is an unrealistic pile of red pixels. You don't shoot a gun, you press a Ctrl key. It's not a bullet flying, just some white pixels moving on a small screen. Nobody thinks anything of the ersatz blood and guts, since that's too ludicrous to take seriously. Like Wile E. Coyote being blown to bits one minute and flattened like a pancake the next, it's a joke. Cartoon humor.

This whole scene began when Mortal Kombat became a hot game. In my opinion, there are few computer games that have true violent content. In fact, the only game I've seen that unquestionably depicts violence is that sick game from Sega, Night Trap, which has been taken off the market. It includes a video clip where some creeps capture a scantily clad girl and take a drill to her skull. Yuk. I'd like to have the Sega executives give the reasons for that scene.

Before computer games are X-rated for so-called violent content, we have to examine exactly what constitutes violence. The violent aspect of DOOM is misconstrued. DOOM is a good game for a variety of reasons. It accepts add-on modules (one module turns any bad guy into Barney the purple dinosaur, who sings "I love you, you love me" while hurling bombs at you), it's extremely well-coded, you can play it online with others over a modem, it's complex, and it's just plain fun. I find the violence comedic. But who decides what's comedic?

For that matter, who decides what's socially acceptable and what's not? When it comes to censorship, the question posed is where to draw the line. Today, the line's drawn at kiddie porn. But under the dubious guise of freedom of expression, that prohibition may someday be withdrawn.

I accept the argument that there's a need for tightening and not loosening standards, but the focus for stricter standards should be on the entertainment industry and not the computer industry. (Unless, of course, the computer industry becomes a mere conduit for Hollywood.) The Hollywood moguls argue that the graphic portrayal of violence is a reflection of society. Stop and ask yourself whether that argument is even remotely true. Violent movies that show hundreds of people killed every minute don't reflect any reality I know. While Hollywood takes credit for influencing and Americanizing the entire world, it denies being an influence for violent behavior. Go figure.

I don't like to jump on the Hollywood-bashing bandwagon, but the Hollywood entertainment business should be the target of censorship. In the mad rush to do something about the gun-toting, crack-smoking, shoot-

'em-up atmosphere we've created for ourselves, we're looking for a quick fix. "Gee, look at those violent computer games. Let's do something about *that*! Maybe stopping that will solve the problem of violence in the streets." Knowing the ways kids think, though, you know they'll just want the more violent games. If DOOM is rated ZZZ (extremely violent), then that's what they'll want.

But let's face reality. Computer games are nothing more than cartoons. And in my opinion, cartoons are not the problem.



Gratuitous violence in computer games is not the problem. The problem is Hollywood.

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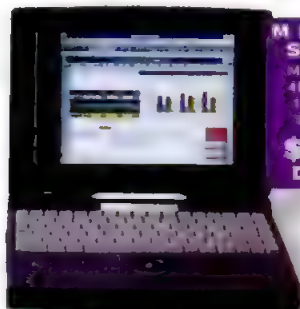
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Inside Track

W

hat's Intel Corp.'s latest plan to hold its lead in micro-processors? Multi-processor machines seem to be the answer, even though it may turn out to be an inefficient way to increase performance. According to Intel engineers, when you add a second Pentium to a Pentium system and run the appropriate operating system (OS/2 for Symmetric Multi-Processing or Windows NT), you **only get a 60 percent increase** in performance. To double the performance, you need three Pentiums (roughly a 220 percent performance increase.) This gets expensive fast.

This must all be resolved by March of 1995 when the "serious" PowerPC chip—the 604—becomes generally available, probably as part of a number of shipping machines, including the **Apple Mac PREP** (Power REference Platform) computer, which will be announced in the first quarter. It'll be loaded with a PCI bus and will probably be able to run IBM PC operating systems, such as Windows NT and Workplace OS.

We've heard a lot of talk about the PREP standard that IBM and Apple are working on to **unite the platforms**. IBM insists that the IDE standard be incorporated into the Mac environment as specified by IBM. Apple feels it's not important. It now seems as if the PREP standard will actually be two standards when it arrives. It'll be up to the talented **hackers** out there to make these two platforms compatible. These big companies have **too many hidden agendas** and too many bureaucratic layers to do this thing efficiently.

Remember Presentation Manager for DOS? This was a promise of IBM about two years ago. It was a good idea and, in fact, was largely a finished product when first proposed. An outside programming group accomplished the task. First, there were legal problems. **Nobody at IBM** wanted to sign off on the project. Then, the marketing people for OS/2 got into the act. Then, executives unsure of the value of Presentation Manager for DOS got into the act. Before you knew it, the product languished. Soon, because of the never-ending personnel changes at IBM, the flag carriers were off doing something else and we never heard about this product again! It simply disappeared. Another good idea that **hit the brick wall**. Can you spell T-E-A-M-W-O-R-K?

Meanwhile, **Microsoft is showing moxie** by experimenting with different front-ends for Windows NT. Windows NT is the leading candidate for winning the

The "serious" PowerPC chip—the 604—should be available in March. It'll be used in the Apple Mac PREP machine that'll run operating systems for the IBM PC as well as System 7. Watch for an announcement early next year.

operating systems war over the IBM version of the PowerPC. Note that while **Microsoft likes to whine** about the death of OS/2, the company has been experimenting with a Presentation Manager front-end for Windows NT. Microsoft still has rights to all OS/2 technology. According to reports, this experimental OS/2 shell was developed at the facility in Haifa, Israel, where I saw Windows NT with a Chicago front-end. I believe that Microsoft is forming a strategy to defeat any potential for Workplace OS, which is supposed to have a variety of front-ends when and if it's ever announced.

Because Microsoft has the code for some of the more popular applications (Word, Excel, and so on), it

can simply **look out Workplace OS** by porting its apps to NT only. It's as if they're saying, "If you like the OS/2 interface so much, just use this! We don't see any reason to port to Workplace OS when PowerPC users can run Word under Windows NT."

The Irony is that in the early 1980s, IBM was in the applications business and, in fact, was the largest supplier of PC software. Under the old regime, the company didn't see any benefit in the strategy and abandoned the applications business. It was some sort of corporate arrogance that led IBM to believe it would never be **outfoxed and outmaneuvered** at every turn by a small company in Redmond, Washington (of all places). With every passing day, it becomes more and more unlikely that IBM can prevent Windows NT from dominating any new platform.

Old Monitors Never Die Dept.: My house has one of those built-in sprinkler systems to keep the place from going up in flames during a forest fire. Once in a while these systems fail, as happened in my office a few months back. **Everything was ruined** (I thought) as a torrent of water hit everything and the roof caved in. Under the debris was a **Phillips 17-inch Brilliance monitor** that I put aside to dry out. I made a bet that the monitor, flooded with water and dirt, would never work again. After two months, I fired it up and it worked **good as new!** Thought you should know.

Tidbit: Do you like fast-paced **hot games** such as that Sonic the Hedgehog game on the Sega? Look no further than Jazz Jackrabbit—an **absolutely stunning** PC-based arcade-style game every bit as good as anything found on a dedicated game machine. It comes from Epic MegaGames, 3204 Tower Oaks Blvd., #410, Rockville, Maryland 20852; 800-972-7434; fax: 301-299-3841. You get all six levels of the game for \$39. It's kept my nine-year-old son busy for two weeks (so far!). **Highly recommended.** □



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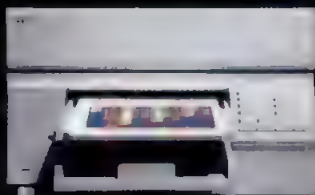


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CIRCLE 083 ON READER SERVICE CARD



Jim Seymour

Surfing the New Wave(table)

For most of us, it's never been so easy to buy a decent sound card. For some of us, it's never been so hard.

These days practically every PC maker offers a built-in sound card—as an option, if not (as in many higher-end PCs) as

a no-extra-cost feature. Though some vendors still foist off old, noisy, underpowered 8-bit FM-synthesis cards in these factory-installs, many PC makers offer up-to-date 16-bit wavetable cards.

Certainly, buying a new computer with an audio card already installed is the easiest way to PC sound. Indeed, the grief of installing first- and second-generation sound cards as upgrades in older PCs led to the tongue-in-cheek advice I'd give friends asking about adding sound: Throw away your PC and buy a new one with a preinstalled sound card.

Many cards today aren't nearly so hard to install. The best of them offer much better sound, more versatility, and better software compatibility than the industry standards of just six months ago.

Still, whether you're buying a new PC or putting a sound card in an existing PC, picking the right card can be confusing.

If sound isn't a big deal for you—if, say, you're not terribly picky about sound quality on car stereos or at home—then this is easy: Get a 16-bit wavetable card, and buy a couple of decent powered speakers. (For more information, see "Turn Up the Volume! Powered Speakers For Your Home PC" in our After Hours section of July 1994.) Unless very low cost is paramount, don't accept an 8-bit card and avoid FM-synthesis cards.

But what if you want really good sound? Avoiding the "frying bacon" sizzle of 8-bit cards and the *beeps* and *boops* of FM-synthesis cards isn't enough. There's a world of 16-bit wavetable products available, from those under \$100 to those over \$300, and choosing among the maze of features in these packages can drive you batty.

It's almost impossible to actually audition a variety of different sound cards in comparable hardware settings. Sadly, I've never seen a PC retailer set up a row of identical PCs with a different sound board for each. Buyers wind up reading the promotional copy on several sound-card packages, comparing software bundles, and wondering how they're supposed to tell what something *sounds* like from its back-of-box copy.

NEXT CANDIDATE

I've spent much of the last couple of months auditioning new sound cards: shuffling them in and out of PCs, setting jumpers, changing IRQs, playing CD-ROMs and audio CDs through them, and connecting different speakers and headsets to them. (You say listening to Bach and playing PC games by the hour doesn't sound so bad to you? Oh, it's a nasty job, but somebody's gotta do it. . . .) I found four new sound cards so good that I think they'll redefine your expectations for PC sound. All sound great; you'll be happy with any of them. While the time and difficulty of installing them vary, those differences arise from the specific features of each card—and all of them are easy enough for any competent adult to set up in less than half an hour. I rate ease of installation as being very good for all.

One caveat: My tests were highly subjective and are not comparable to our highly quantified PC Labs tests. And while I looked at a wide range of sound cards, I didn't test them all.

Advanced Gravis' UltraSound card was one of the sleepers of the last generation of sound cards. Easy to install, with very good sound, it was a great buy. Gravis has now introduced the UltraSound Max, which is the lowest-priced good-quality sound card I've seen. It's also easy to install, and



16-bit wavetable sound cards mean you'll never have to put up with bad sound again.

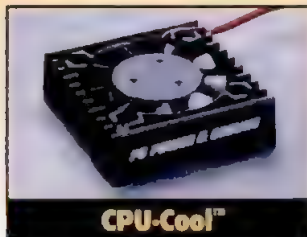
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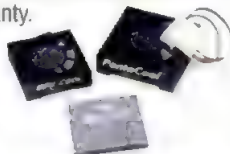


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CIRCLE 080 ON READER SERVICE CARD

Jim Seymour

it's a screaming bargain at \$179.

Gravis promotes the board's use of 3D Holographic Sound, a surround-sound-style effect. I found the 3-D effects subtle, to put it gently. Since such effects require explicit support in game software—not yet widespread—you won't hear them very often.

Logitech's SoundMan Wave card costs just a bit more than the UltraSound Max, about \$200 on the street. It's another sweet-sounding card with easy installation. This is a great card for gamers: It was the most Sound Blaster-compatible card I tried.

The UltraSound Max and the SoundMan Wave are my low-price picks. With wavetable sound, General MIDI, 16-bit stereo recording and playback, MIDI/joystick ports, and good software bundles, they're the value leaders.

Two more cards demand consideration for their special features and extraordinary performance.

Turtle Beach's MultiSound was the first really high-quality PC sound card. Now, Turtle Beach has replaced it with the MultiSound Monterey, a combo board that piggybacks the company's Rio MIDI-synthesizer daughterboard onto its Tahiti wavetable card. The result is awesome sound and incredible flexibility. At a price: about \$350.

This isn't a card for games: It makes no effort to be compatible with the Sound Blaster or Ad Lib standards (but when more games use MIDI sound, it'll be a killer game/sound board). But you get professional MIDI support and the ability to create, save, and download your own sounds onto the board (expanded with optional SIPs memory).

Finally, Adaptec's new SCSI Audio-Machine combines an industry-standard SCSI/SCSI-2 interface with very good, DSP-based wavetable sound. Many sound cards offer the proprietary Mitsumi and Sony CD-ROM interfaces; only Adaptec gives you a fast SCSI adapter for higher-performance CD-ROM drives (and other SCSI peripherals, such as hard disks, scanners, and tape backup units) on a standard ISA card.

If you already have a PC with an IDE hard disk, the Audio Machine is a great upgrade, an easy way to add on sound plus a SCSI daisy chain with a CD-ROM drive and more, all from one expansion slot, for about \$300.

Find it hard to choose? Me, too. □

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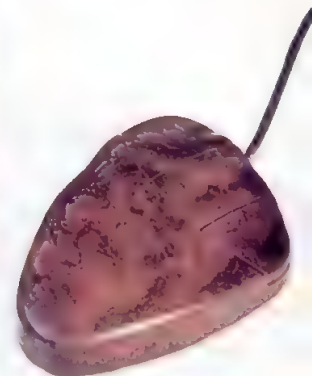
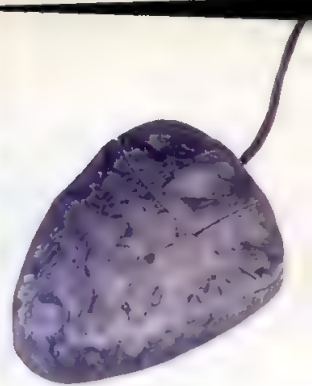
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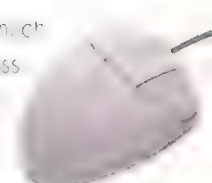
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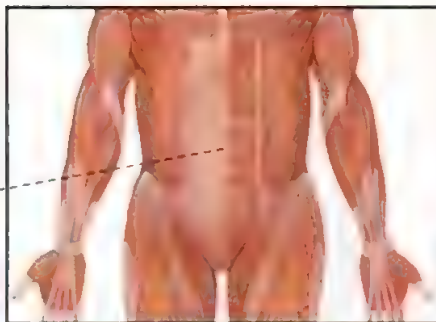
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CIRCLE 178 ON READER SERVICE CARD



Bill Howard

Make Mine a Double Double

Dual floppy disk drives were standard equipment for power users during the first decade of the PC's existence. In the 8088-PC era, before hard disks were common, you had a pair of 360K drives. You installed both high- and low-density disk drives in the

PC AT era, and 5.25- and 3.5-inch floppy disk drives more recently. Now, the 5.25-inch floppy disk drive is dead, replaced by the CD-ROM drive as the second removable drive in the computer.

GETTING UP TO SPEED

Single-speed CD-ROM drives are dead; they're pariahs, and even the closeout catalogs don't touch them any more. Double-speed CD-ROM drives—with 300-kilobyte-per-second data-transfer rates—are the standard. You can buy decent double-speed CD-ROM drives such as our Editors' Choice Sony CDU-33A for about \$150 today; by early 1995 they may fall to \$100 at retail, at which point their cost is a nonissue in a \$2,000 PC.

The only triple-speed CD-ROM drive of note, the NEC MultiSpin 3X, had early teething problems and hasn't been a smash success. Also, triple speed wasn't faster enough to make a huge difference. We all know you can't notice a 10 percent performance improvement on a desktop PC. A 50 percent performance improvement begins to get interesting, but the performance jump that really makes you sit up and take notice—that makes you think about upgrading—is 100 percent. And that's why quad speed looks interesting: Data transfer is at 600 KBps. Access time is only marginally faster than with a double-speed drive. (Access time means the time lapsed until the read head finds the first bit of data; transfer rate refers to the speed with which the data stream moves.)

Why bother with quad speed? Because only when you reach quadruple speed do you have a good chance of displaying multimedia without dropping video and sometimes audio frames. There have only been a handful of quad-speed drives until now, and some

of them have been frightfully expensive, approaching \$1,000. You should see new quad-speed drives introduced by year's end, many priced at below \$500. By the midpoint of 1995, as drive makers shift from SCSI to cheaper IDE interfaces, aggressively priced quad-speed drives will dip below \$300. Already TEAC's SuperQuad 4X drive streets out at a shade over \$400.

TWO DRIVES ARE BETTER THAN ONE

I believe power users will want two CD-ROM drives available at all times: one for an application they constantly use, such as a dictionary or phone directory, and one for applications or games they use only for parts of the day. You also can expect to see applications next year that spill across to a second CD; 660 megabytes just isn't what it used to be. Having two CD-ROM drives means you'll want to look into a mini-tower rather than desktop-style case on your next PC. I believe mini-towers are the best combination of space efficiency and expandability, and it perplexes me how the biggest PC vendors try to tell you a desktop PC turned sideways is just as good.

Quad speed is an evolutionary step in data storage and delivery. The revolutionary steps over the next few years will include writable sub-\$1,000 CD-ROM drives, higher-capacity CD-ROM drives of at least 1 gigabyte; and read/write CDs (you can write, read, erase, and write again).

Ultimately, however, when we have ultra-high-speed wired or wireless connections linking every PC everywhere, it will be just as easy to access the master copy of the *Oxford English Dictionary* sitting in a library in the U.K. as it will be to have the *OED* in your desktop CD-ROM drive. By the turn of the century, you'll only need one CD-ROM drive again—if that many. □



The future of CD-ROM drives lies with quadruple speed, but hang on to your existing double-speed drive.

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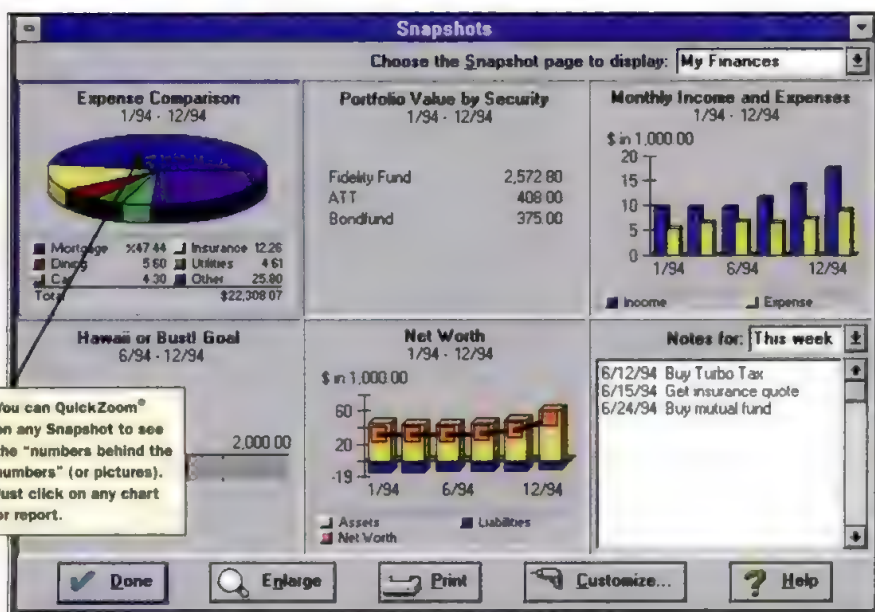
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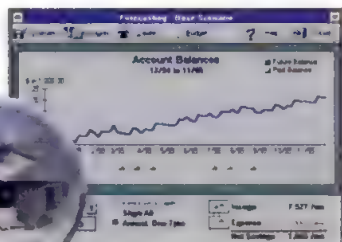


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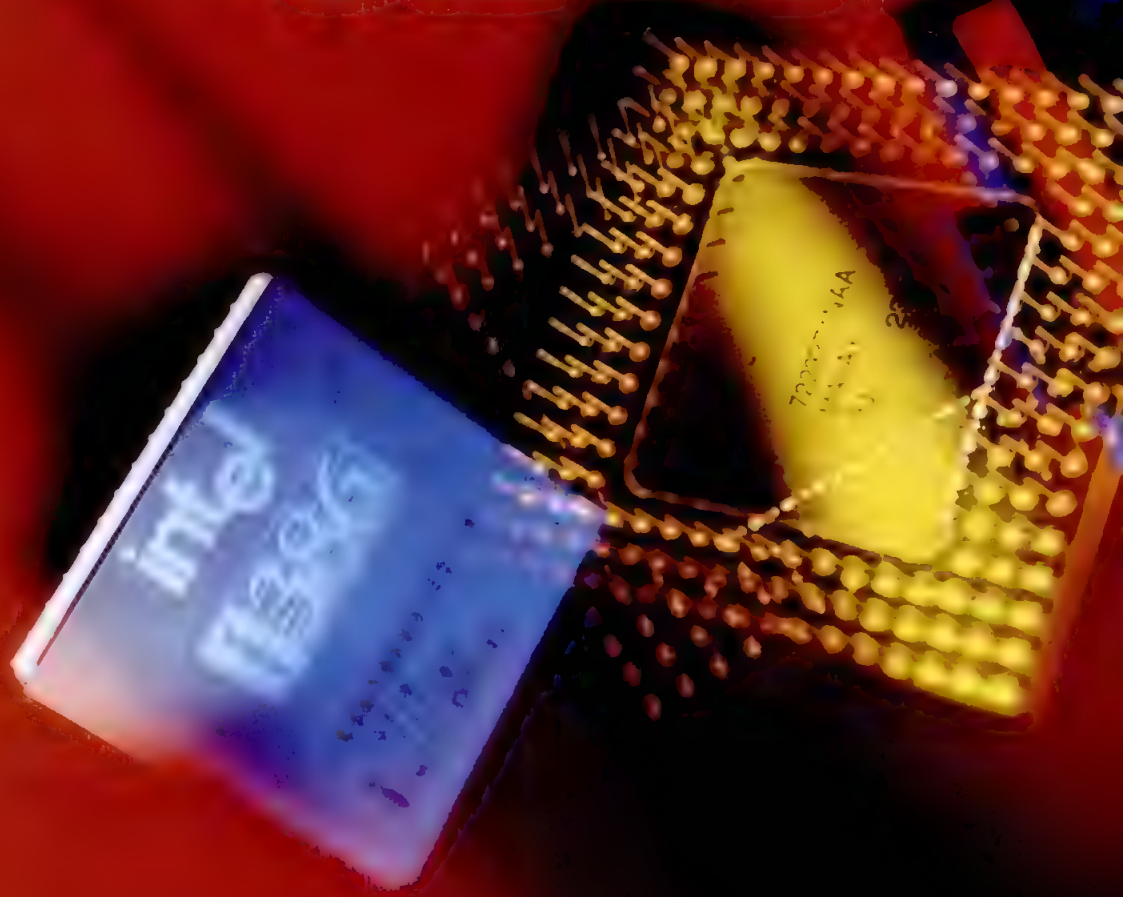
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PROCESSOR UPGRADES

New Life *For Your* Old PC?





CPU upgrades let you breathe new life into aging systems. But can they compete with the value of aggressively priced new machines?

By Winn L. Rosch

It's not easy to accept, but it's true: Technology is conspiring against you. The moment you bought your PC you were locked into technology destined to slip ever further behind the leading edge. And often that obsolescence happens faster than you ever imagined it could.

The evidence is abundant. A top-of-the-line PC from just three years ago now is decidedly dated. In 1991, 486 CPUs were still relatively new, and the fastest chips ran at a clock speed of 33 MHz. Clock-multiplying processors and superscalar x86 designs such as Intel's Pentium were mere dreams.

By contrast, even entry-level PCs today are powered by 50- or 66-MHz 486 processors—for which you can thank (or blame) Microsoft Windows and the increasing demands of graphically oriented applications. You could easily look back and laugh at what once passed for powerful, except for one thing: There's a good chance that the PC on your desk has been there for two or three years. If it has, then chances are also good that you've pushed it to the limit by now, and

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you're getting hungry for more power.

The easy answer is to buy a new PC. But in this budget-conscious time, that may be difficult: Even though increases in computing power have been accompanied by steadily decreasing system prices, a modestly configured new machine will still cost over \$1,000.

STOPGAP MEASURES

Of course, there are alternatives to buying a new PC. If you just want to boost performance, without adding disk capacity or improving your display subsystem, upgrading your CPU might seem like a good solution. Most systems' CPUs can be upgraded by one means or another, even if they weren't designed to be.

Market research by both International Data Corp. (of Framingham, Massachusetts) and Mercury Research (of Scottsdale, Arizona) estimates the number of 486-based PCs that can use upgrades at around 55 million by the end of 1994. Mercury Research also says that about 30 to 35 million 386-based PCs are potentially upgradable.

Opinions differ wildly on how many of those systems will actually be upgraded. While historically 5 to 10 percent of the installed base of 486s have gotten such transplants each year—that's 2.5 to 5.5 million systems by the end of 1994 if that

trend continues—Mercury Research believes fewer than a million PC owners will upgrade yearly. Reliable numbers are hard to come by, because chip makers don't reveal how many upgrade chips they sell. Using public disclosures, however, you can make your own estimates. Cyrix Corp., for example, reports that 10 to 15 percent of its revenues (which, based on first quarter performance, should total about \$240 million this year) comes from upgrade chips. Allowing for typical margins, that translates into 200,000 to 300,000 upgrade chips per year, or about 1 percent of the installed base of 386 systems. That's fewer than the optimists predict, but it's still a significant number—and it represents the sales of only one upgrade-chip manufacturer.

One real advantage of CPU upgrades is that you won't spend time transferring data files from one PC to a new one. Conventional wisdom tells us that another advantage of upgrades is that they preserve your investment in hardware—albeit hardware

that's all old. Chances are, by the time you're ready to upgrade your CPU, it's time to upgrade your memory, hard disk, and video subsystem as well. The cost of upgrading those components could easily exceed the price of a new machine—and you won't get the benefits of recent improvements in system architecture, such as

PCI. Furthermore, upgrades take time; they're not guaranteed to work; and factors such as inaccessible CPU sockets can hinder the process.

REVIEW CRITERIA

To see which CPU upgrades make the most sense, PC Magazine Labs tested a variety of

products that can upgrade 386 or 486 CPUs. Although upgrades for 286-based PCs exist, we chose not to test them, because we believe that 286 systems' designs and peripherals are so antiquated that upgrades don't make sense.

We could not test Intel's DX4 OverDrive upgrade for 486 systems because it was released after we finished this story. Intel is scheduled to release the long-

Upgrading Your 386

CPU UPGRADE.....	\$250.00
RAM UPGRADE.....	\$200.00
GRAPHICS ACCEL.....	\$225.00
HARD DISK.....	\$300.00
TOTAL.....	\$975.00

NEW PC.....\$1,400.00
(WITHOUT MONITOR)

HIGHLIGHTS

CPU Upgrades

CPU UPGRADES PROMISE to revitalize slow PCs for less than it costs to buy a new machine. Most 386- and 486-based systems can benefit from CPU upgrades, but performance improvements may be less dramatic than you would expect. Consider first whether you would be better served by upgrading other components or even by buying an entirely new system.

WINDOWS PERFORMANCE IMPROVED by a mere 10 percent or less with some upgrades—hardly enough to justify costs of \$249 to \$2,299. The most effective upgrades were Compaq's processor-replacement boards, which include their own RAM and, in some cases,

external processor cache. But the Compaq solutions are expensive, costing as much as \$2,299—more than the price of a comparable or faster new PC.

CHIP REPLACEMENTS, such as the IntelDX2 OverDrive processors, Cyrix's Cx486DRx² processors, and Evergreen's Rev To 486 upgrades, are some of the simplest and most popular upgrade solutions. Their downside: a limited performance boost, because the faster processor must still communicate with old, slow system components over a narrow expansion bus.

COMPATIBILITY ISSUES make upgrading a risky proposition. Before

you buy, call the manufacturer to check that an upgrade is certified to work in your system. One particular problem: Many early 386SX/16 CPUs don't have a *float pin*, meaning that the processor can't easily be disabled. Physical impediments, such as inconveniently located drive cages, can hinder upgrades as well.

INTEL'S PENTIUM-BASED OverDrive processor should ship around year's end. Until then, Pentium upgrades still won't be possible for most machines. The exception, however, is Compaq's Deskpro/M line, which can accept up to a Pentium/60 processor.

awaited Pentium-based OverDrive processor around year-end. Some vendors offer RISC upgrades for Intel-based PCs, but we did not test any; if you really want the power of a RISC workstation, and have the software to run on it, buy a machine expressly designed for that purpose rather than upgrading an x86 PC.



In this review, you'll find coverage of CPU-upgrade products from: Compaq Computer Corp., Cyrix Corp., Evergreen Technologies, Intel Corp., and Kingston Technology Corp. We also discuss a more drastic approach to CPU upgrades—motherboard replacements—in “The Motherboard Swap: Yes or No?”

Since CPU upgrades aren't the only way to improve the performance of your PC, we tested graphics-board and memory upgrades and combinations of multiple upgrades to determine what is the most effective way to spend your money. For the results of these tests, see the sidebar “The Price of Performance: Component Upgrades.”

THE OPTIONS

There are nearly as many methods of performing a CPU upgrade as there are products to do it. The options include direct chip replacement and plug-in chip replacement assemblies to adapt newer chips to older sockets; CPU cards that plug into an expansion-bus slot; and proprietary processor upgrade boards. Prices for the upgrades we tested vary from a low of \$249 to a high of \$2,299.

Which of these upgrade options you can use depends on your PC. (For an overview of the choices, see “Determining Your Upgrade Options.”) Direct chip replacements have the widest application, since you can upgrade any system if you can replace the CPU directly. In some cases, you will pull out the original chip and drop in a new one. In other cases, you will insert the new processor into a second CPU socket (such as an OverDrive socket), which will electrically disable the original CPU. Replacements for 386SX chips

• No Editors' Choice: disappointing price/performance ratios

Given the rock-bottom prices of new machines, we don't think the price/performance ratio of any of the CPU upgrade solutions merits an Editors' Choice award. That's doubly true given the limited

compatibility of many of them.

Still, we award honorable mentions to two product lines: Compaq Deskpro/M Processor Board Upgrades and Kingston's MCMaster cards, both of which are families of expansion cards with CPUs on board. Compaq's Processor Board Upgrades, which range from a 486SX/25 to a Pentium/60, do provide dramatic performance improvements for Deskpro/M machines. But that capability comes at a price: \$399 for a 486SX/25 upgrade, and as much as \$2,299 for a Pentium/60 upgrade.

Kingston's MCMaster boards provide a similar performance boost, doubling or tripling the performance of 386-level systems. The catch: They are specifically designed for IBM PS/2 Models 55, 56, 57, 65, 70 and 80 only.

STOPGAP MEASURES

For 386 users, the Cyrix and Evergreen chip replacements can provide

are secured on top of the original chip.

Intel reports that virtually all 486SX and 486DX systems, whether they have an OverDrive socket or not, are candidates for its OverDrive chips. Cyrix's chip-replacement upgrades are available for almost any 386 system, except some early 386SX/16 models. IBM and Texas Instruments CPUs are available as upgrades from Evergreen Technologies. Advanced Micro Devices processors are used on Kingston's MCMaster boards, which we reviewed.

Plug-in upgrade assemblies, such as

a stopgap measure that will extend the life of a PC by perhaps a year. They improved processor performance by 44 to 122 percent on our tests—nothing that compares with even a low-end 486 system, but a comfortable boost nonetheless.

For 486-based systems, the IntelDX2 OverDrive processors provide less of an incentive to upgrade. Since they currently top out at the 486DX2/66 level, you just won't see enough of a performance improvement to justify their price. When the clock-tripled DX4 and Pentium-based OverDrive upgrades become available, they may be worth a look.

Motherboard upgrades avoid the bottleneck that occurs when you drop a fast new processor into an outdated system architecture, but such upgrades can be difficult. If you're comfortable wielding a screwdriver, though, you may find them the next best thing to a new PC.

those provided by Evergreen Technologies, are also available for a wide variety of PCs. The biggest potential obstacle to upgrading with these products is physical; other components in the system, such as drive bays and full-length expansion cards, may make it difficult or impossible to squeeze the chip and the small board it's seated on into the system.

Then there are CPU upgrades specific to a particular line of machines. In Compaq's Deskpro/M line, for example, the CPU and memory chips sit on a proprietary processor card. To upgrade your system, just pull out the old card and insert a new one. Kingston Technology Corp.'s MCMaster products, which work only with specific models of IBM PS/2 machines that are based on the Micro Channel Architecture, are processor

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◆
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◆
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◆
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◆
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◆
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MS-Windows 3.1, TabWorks, and
Microsoft Video Windows (Runtime)



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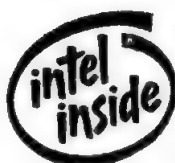
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♦
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■ CPU vs. Component Upgrades

If your PC feels too slow, your first temptation may be to blame it on the processor and decide it's time to upgrade whatever old CPU is under the hood. But the CPU is only one component that determines your system's performance, so before you lay down the cash to buy a processor upgrade, consider whether or not your money might be spent more effectively somewhere else. Would a new graphics card or more memory do just as much good?

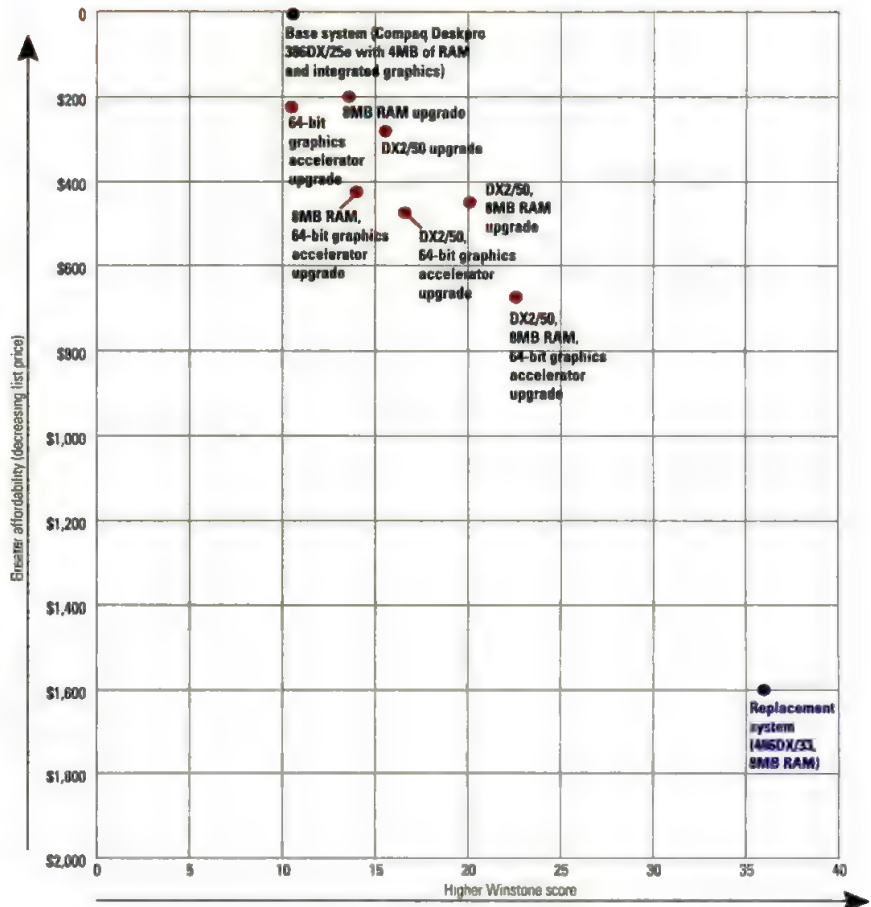
WHAT TO UPGRADE?

The accompanying chart illustrates the price/performance benefits of different component upgrades. We started with a Compaq Deskpro 386DX/25e with 4MB of RAM and integrated graphics and upgraded a variety of components (alone and in combination) to find the most cost-effective solutions. We plot the base system's price at \$0 on the assumption that the user already owns a system.

Our base system posted a score of 10.2 on our Winstone test, which measures performance running typical Windows applications. A processor upgrade alone yielded a 51 percent improvement in Winstone performance. We used Evergreen's Rev To 486 (386DX2+) processor, based on a clock-doubling TI 486SXL/2 CPU.

Expanding RAM from 4MB to 8MB resulted in a Winstone score of 13.6, about a 33 percent performance improvement. Because the RAM upgrade—about \$200—costs \$50 less than the CPU upgrade—\$279 list, about \$250 on the street—its price/performance showing was similar.

Despite Windows' significant demands on graphics subsystems, upgrading the graphics board proved to be the least-effective path to improved performance. We supplanted Compaq's integrated graphics with a state-of-the-art, 64-bit, ISA-based



graphics board from ATI Technologies and observed only a 3 percent improvement in the system's Winstone score—hardly a justification for the board's typical street price of \$225. Of course, the board's effect on graphics-intensive operations was much more dramatic; it tripled the system's score on our Graphics WinMark tests. The bottom line, however, is that a speedy graphics board alone won't get your work done significantly faster.

We did not specifically test the performance effects of hard disk upgrades, basically because we suspect that users buy hard disks based on the amount of storage space they need and not because of a hard disk's impact on total system performance.

COMBINATIONS

In general, we achieved the most cost-effective upgrade by combining a processor upgrade with 4MB of additional RAM. For a total street price of about \$450, this doubled the system's performance running typical Windows applications. Even so, that level of performance is only slightly better than half what you would expect from buying a brand-new low-end PC.

With 33-MHz 486-based systems selling for about \$1,600—which includes a larger hard disk than what is installed in a typical 386-based PC—we believe the most sensible solution of all is to bite the bullet and give up on your old PC altogether.

cards that fit into an MCA slot and exploit bus-mastering capabilities to take over processing functions from the original CPU.

UNDER THE HOOD

How does a faster CPU work to speed up your system? First, it usually boosts clock speed. Second, it often uses a more modern design that executes instructions more efficiently: The 486, for example, is roughly twice as fast as a 386 CPU running at the same clock speed. Within each processor generation, clock speed is the primary determinant of performance.

To allow you to use a faster chip in a slower system without making major alterations to the system's components, chip makers now make *clock-multiplying* processors that operate at a high speed internally but directly connect with slower motherboard components. Examples include the Cyrix SRx²/DRx² series, IBM's Blue Lightning series (upgrade available through Evergreen), and Intel's OverDrive series. These chips operate internally at two or three times their external speed, leading to the terms *clock-doubler* and *clock-tripler*.

The motherboard clock becomes a problem with upgrades because its settings are no longer optimal with the new chip. To compensate for this, some upgrade makers place their CPU upgrades on circuit boards that either integrate a separate clock or can affect the motherboard's clock (like Kingston with the 486/Now! series) to produce the optimal timing. These assemblies still replace your old CPU by plugging directly into its socket.

Increasing the difference between internal and external processor speed creates a mismatch whenever the processor needs to perform off-chip I/O, such as memory accesses. An on-chip memory cache (also known as internal, primary, or L1 cache) helps compensate by duplicating some of the contents of slow system

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step further, providing a larger secondary memory cache (L2) as well. This L2 cache, which uses SRAM chips, isn't as fast as the primary, on-chip cache but is still faster than system RAM. On midrange 486 systems, 64K to 256K of L2 cache is commonplace—because it's necessary in ensuring top performance. Both

RAM in a fast on-chip buffer. The bigger the cache, the less frequently the CPU must wait to retrieve data from outside of the chip; this is why clock-tripling chips, such as those in IBM's Blue Lightning series and in Intel's DX4 series both carry relatively large internal caches (16K).

Most modern systems carry the caching concept a

Compaq and Kingston employ an L2 cache in some of their upgrades.

PERFORMANCE RESULTS

As our testing demonstrates, the performance improvement that these different upgrades provide can vary widely. The greatest performance increases we saw resulted from Compaq's processor-board upgrades. Moving up from a 386DX/25 to a Pentium/60 processor (an upgrade that adds 4MB of memory as well) resulted in a 454 percent improvement in score on our Winstone test. Such an upgrade places the system in line with an average Pentium/60 system you can buy today. But since Compaq would be happy to sell you a new system, that upgrade comes at a substantial cost: \$2,299, including a trade-in on the original processor board. Other, less dramatic upgrades were moderately effective; upgrading from a 386DX/25 to a 486DX/33 improved the Winstone score by around 70 percent.

A more price-conscious though still effective solution is offered by some of Evergreen's products. On our Winstone test, the

Determining Your Upgrade Options

Some manufacturers make upgrades for specific systems, and others make upgrades for particular CPUs. Look at both sections in the table below to determine which companies offer options for your machine.

■ = YES □ = NO

SYSTEM TYPE

Compaq Deskpro XE, Compaq Deskpro XL
Compaq Presario, Compaq ProLinea
IBM PS/2 Model 55, 56, 57, 65
IBM PS/2 Model 70, 80

PROCESSOR TYPE

Intel 386SX/16 (without float pin) **
Intel 386SX/16 (with float pin) **
Intel 386SX/20, Intel 386SX/25
Intel 386SX/33
Intel 386DX/16, Intel 386DX/20, Intel 386DX/25
Intel 386DX/33
Intel 486SX/20, Intel 486SX/25, Intel 486SX/33
Intel 486DX/20
Intel 486DX/25, Intel 486DX/33
Intel 486DX/50
Intel 486DX2 (any clock speed)
Intel DX4 (any clock speed)
Intel Pentium (any clock speed)
Non-Intel 386-class
Non-Intel 486-class

SUPPLIERS OF COMPATIBLE UPGRADES					
Compaq	Cyrix	Evergreen	Intel	Kingston	
■*	□	□	□	■*	
■	□	□	□	□	
□	□	□	□	■*	
□	□	□	□	■*	
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□	■	■	□	□	
□	□	■	□	□	

* We discuss this upgrade in our roundup

**Intel 386SX/16 CPUs manufactured before 1991 do not have the float pins that let upgrade processors disable them



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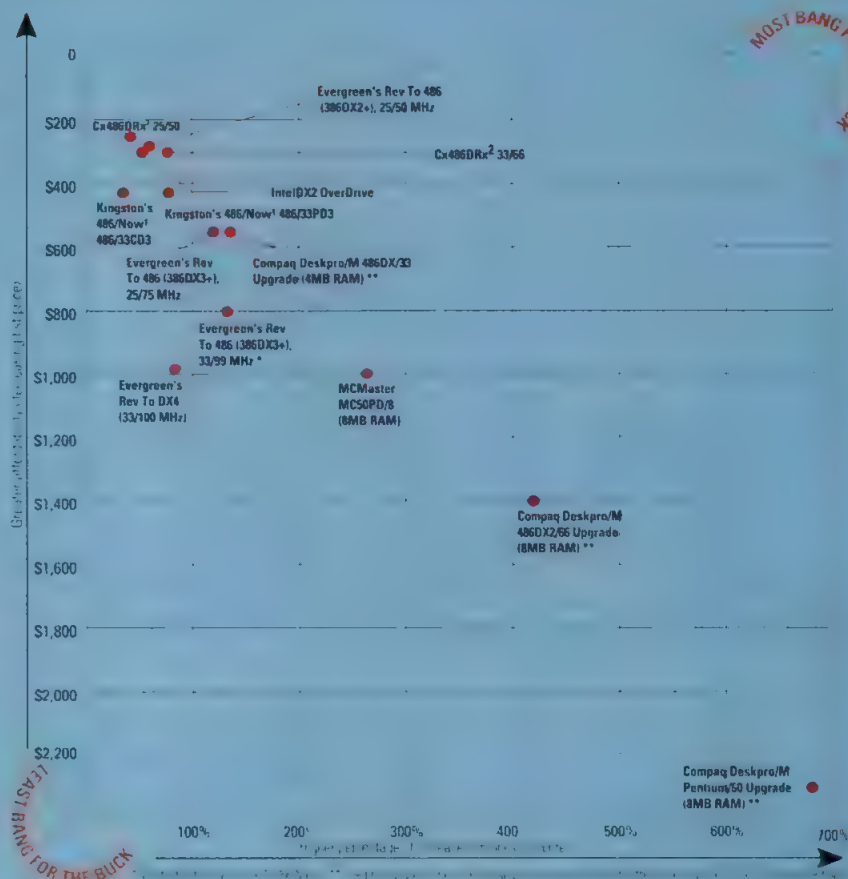
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Price/Performance Index: CPU Upgrades

Comparing the performance gains provided by different processor-upgrade solutions is a dicey practice at best. This is because overall system performance is determined as much by factors such as disk, memory, and video performance as it is by CPU speed. In light of this, our price/performance index shows only the percentage increase in the processor score provided by each upgrade. To determine these percentages, we compared the processor score garnered by each upgrade against that posted by one of our six base systems. For details on which upgrades were performed on which base systems, consult the benchmark test section. Remember that the increase in total system performance (determined by comparing the products' Winstone scores) will not be as high.

The most dramatic increase (nearly 700 percent) was offered by the Compaq Deskpro/M Pentium/60 Processor Board Upgrade with 8MB of RAM. In addition to a speedier CPU, this board provides a new core-logic chip set, a clock, additional memory, and 256K of L2 cache. But you also pay for what you get, as this path costs \$2,299 (which includes the trade-in price of the 386DX/25 processor board from the upgraded system).

Kingston's MCMaster MC50PD/8 board for the IBM PS/2, also a processor-board upgrade, effectively raises CPU performance by 265 percent. Like the Compaq boards, the Kingston board



carries 8MB of system memory. It also carries a comparatively expensive price of \$995.

Direct CPU replacement upgrades (represented here by the IntelDX2 OverDrive and Cx486DRx² chips and by the 486/Now! and Rev To 486 and

Rev To DX4 modules) increase CPU performance anywhere from 36 percent to 134 percent. Prices also vary, ranging from about \$250 to \$1,000. This information is available in the Hardware Library of the Editorial Forum on PC MagNet under 19BANG.XLS.

Evergreen Rev To 486 (386DX2+) (which uses Texas Instruments' 486SXL2 25-/50-MHz processor) boosted the baseline Compaq Deskpro 386/25e's score by 51 percent. And Evergreen's upgrade solution for 486-based systems, the Rev To DX4, produced a Winstone score 33 percent higher than that of the base system, a Micron 486DX/33.

The Rev To 486 (386DX3+) (based on a clock-tripled Blue Lightning CPU), also from Evergreen, provided a Winstone score 76 percent higher than that of the Deskpro 386/25e. When we attempted to upgrade a 33-MHz ZEOS system with this

chip, however, the unit was unable to complete some of our benchmark tests with the chip operating at a clock-tripled rate of 99 MHz. We therefore tested at its clock-doubled rate of 66 MHz, at which speed it yielded a 143 percent improvement over the baseline system on our Winstone test.

Simple replacement upgrade chips—whether Cyrix Cx486SRx² chips, Cx486-DRx² chips, or Intel OverDrive chips—yielded a relatively small overall performance boost.

Kingston's 486/Now! upgrades delivered the least noteworthy gain of any upgrade in this roundup, though Kingston's

MCMaster line boosted performance nearly as much as the Compaq products.

Former PC Labs tests have shown that most new systems soundly outperform any upgraded system based on the same chip. (Note, however, that Winstone scores are also affected by the system's video, memory, and disk performance. Older components present in the base systems used to test the upgrade solutions in this roundup undoubtedly had an adverse effect on Winstone performance.) The system that turned in the worst Winstone score in our last survey of Pentium/60 and Pentium/66 systems, for ex-

*All He Does
Anymore Is Tie Me
Up In The
Backyard...*

Dr. K. Nig



You see... it's like this Doc... Gateway 2000 is man's new best friend. I used to think I was top dog.

I was so much happier before his Gateway 2000 P5-90XL became a bone of contention between us. Walks, roughhousing — we even watched the late show together. Now his biggest passion is his Gateway P5-90XL. The cur.

It's not like I haven't tried. But, I guess I've been barking up the wrong tree, because no matter how much I try to impress him, his Gateway PC makes him happier and happier every day! And although I'm a mere canine, I know the Gateway P5-90XL is a powerhouse. I've heard about its phenomenal features, especially the Microsoft Office Professional applications — MS[®] Excel, Access[®] database, PowerPoint[®] presentation graphics program, Word and Bookshelf[®] '94. That's everything he needs even for his demanding work.

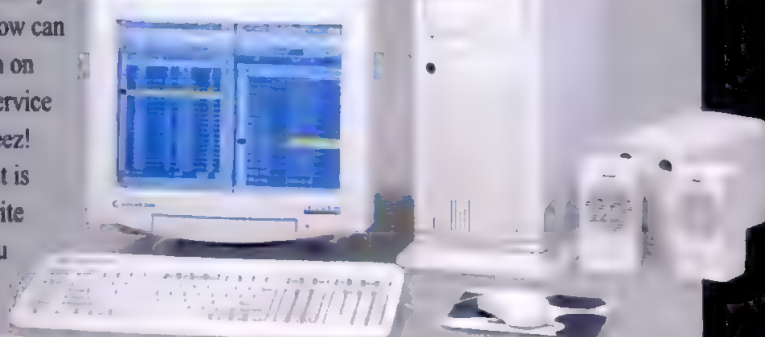
He's a veterinary scientist, so he loves to number crunch, create databases, write reports and integrate his findings into presentations. Sometimes I think he'll chase his tail when he talks about the power of the Intel[®] Pentium[™] processor and how fast he calculates the cases of feline viral rhinotracheitis in purebred Siamese cats in the Pacific Northwest using Excel. Plus, the P5-90XL's 16MB of RAM and a whopping 1GB hard drive give him tons of room for his Access database on diseases afflicting short-haired cats in the twentieth century. (I say let the cats die!)

With his P5-90XL he can even run multiple applications simultaneously. He drools about the Object Linking and Embedding (OLE) feature that automatically updates information in an application after he changes it in a different program. And he pulls up feline anatomy images on his 17-inch CrystalScan[®] monitor in seconds with the lightning-fast speed of the ATI Mach 64 video card. This PC is perfect for him.

When he wants to relax he listens to his favorite music CDs on his Gateway PC. The Ensoniq[®] Soundscape wavetable sound card delivers unbeatable audio quality, and Altec Lansing ACS-31 speakers pump out great highs and heart-pounding bass.

He also goes on and on about Gateway's award-winning service and support and their friendly Midwestern employees. The company's three-year warranty on parts for desktop systems and Gateway monitors is incredible. That's 21 dog years! Gateway customers also get a 30-day money-back guarantee and toll-free technical support. On-site service is available during the first year in most U.S. locations and may be provided without charge if their technicians determine it's necessary. These factors are vital when purchasing a PC in today's dog-eat-dog computer industry.

What's that, Doc? How can you get more information on Gateway PCs and their service and support policies? Geez! Even my own psychiatrist is hounding me. Call or write them and they'll send you a free written copy of their warranty.



8 0 0 - 8 4 6 - 2 0 6 3

Yes, Dr. Nine, the power of Gateway's Pentium™-based PCs has been unleashed! It's an epidemic that's spreading from one member of my family to another. Now *she* even has a Pentium-based system from Gateway. I can see why Dataquest,® Inc. reported that Gateway 2000® is the leading supplier of Pentium PCs in the nation — they're everywhere!

She's a freelance writer, and ever since she got her P5-90 Best Buy from Gateway 2000 all she does is rave about its amazing features that increase her productivity — like its 540MB hard drive, 8MB of RAM and a super-fast double-speed CD-ROM. I have to admit, she pumps out tons of work now, and it keeps her out of the doghouse because she never misses a deadline.

She especially digs Microsoft® Bookshelf® 1994 that's part of MS Office Professional. It makes research a snap! Bookshelf includes seven best-selling reference books including *The American Heritage Dictionary*, *The Original Roget's Thesaurus*, *The Columbia Dictionary of Quotations*, *The Concise Columbia Encyclopedia*, *Hammond Intermediate World Atlas*, *The People's Chronology*, and *The World Almanac® and Book of Facts 1994*.

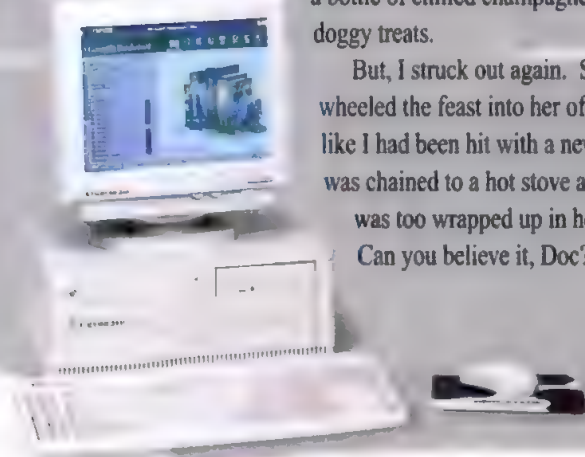
Of course, MS Word, the most popular word processor for Windows, has cool features like spelling and grammar check (she can spell check in 20 languages!), thesaurus and word count. She can even use Word and Bookshelf simultaneously!

Scheduling has never been easier with MS Schedule+ for Windows.™ It helps manage her time, and she can see her schedule at a glance. The PCI local bus graphics and 15-inch CrystanScan® monitor give her an incredible display. It's simply mesmerizing how much her Pentium-based PC has changed her life. Plus it was a great deal at \$2,499!

I'm glad she loves her Gateway PC and all of its awesome software, but now *she's* ignoring me too! She's so engrossed with her P5-90 Best Buy she hardly stops to eat.

One day I prepared her a lunch fit for a queen. An elaborate feast really — Belgian endive salad, savory herbed croissants, wild rice pilaf, grilled apricot-ginger chicken breasts, and white chocolate cheesecake with luscious strawberry glaze. I threw in a bottle of chilled champagne and a few of my favorite doggy treats.

But, I struck out again. She didn't bat an eye when I wheeled the feast into her office. I was stunned — I felt like I had been hit with a newspaper! How could she? I was chained to a hot stove all day. But as usual, she was too wrapped up in her Gateway PC to notice me. Can you believe it, Doc?



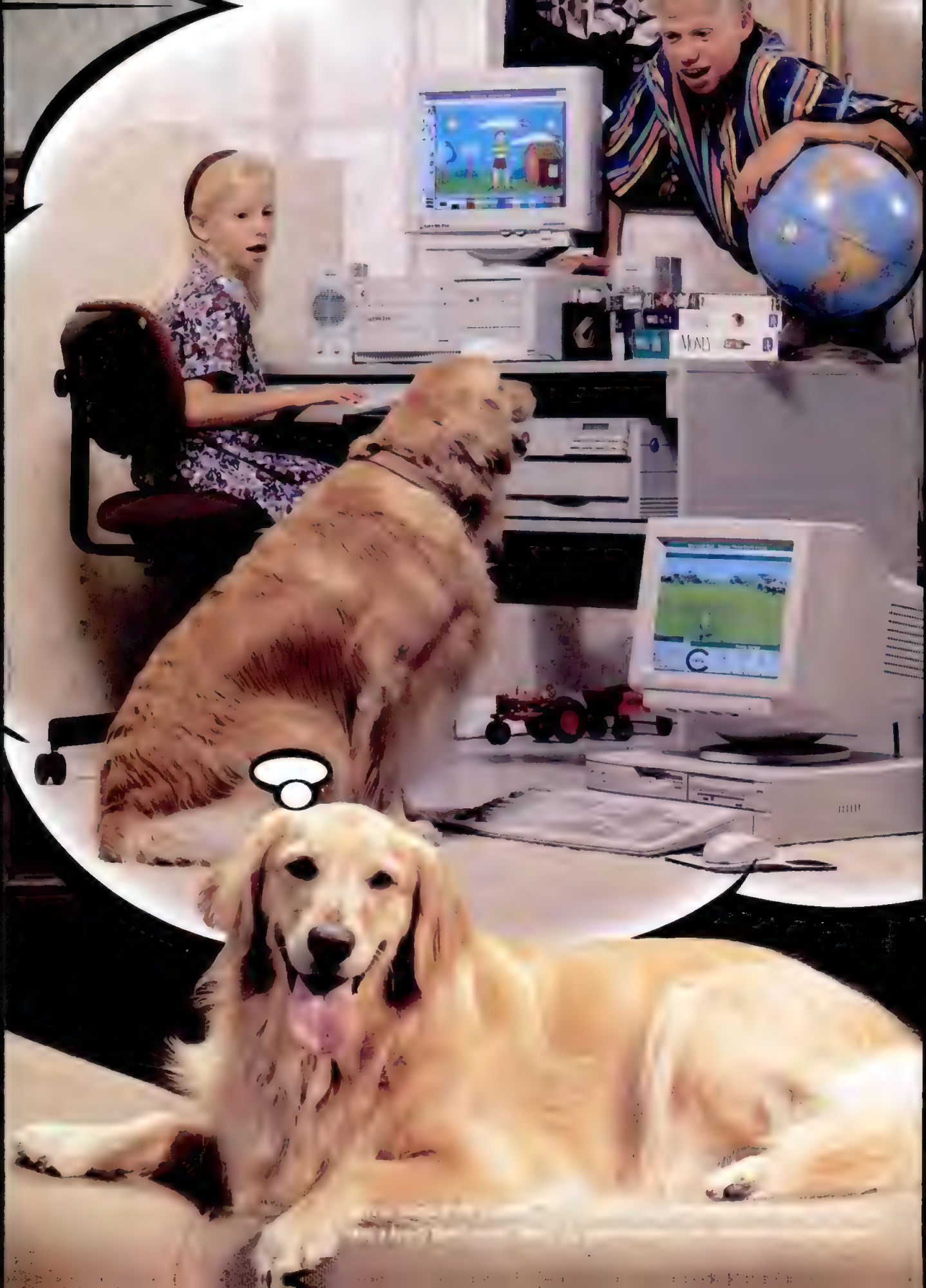
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pentium
PROCESSOR







Doc! I have the solution. I'll get my paws on a Gateway 2000 PC too!
Why was I such a bonehead? Now I'll be part of the family again.

I'll get a 4DX2-66 Family PC™ — a doggone good value at only \$1,899. The kids already have a P5-60 Family PC. I've seen how quickly they can finish their homework with the power of a Pentium-based system. They write reports in no time flat when they use Microsoft® Works® word processor with spell check and thesaurus, along with unlimited resource information from MS Encarta 1994 Multimedia Encyclopedia. And, when they finish their homework early, they can explore the magic behind the movies with MS Cinemania '94, plus exciting software applications designed just for kids.

Now this new world of education and excitement can be mine too. I'll use Encarta to research my pedigree, and I'll plan for my retirement with MS Money™ — the kids have already formulated their college savings funds with this practical application.

I can even kick back and relax with the wonder of MS Multimedia Golf, and with the Family PC's high-quality sound cards and speakers, I can play music CDs, hear audio clips or record audio — all with stereo sound that delights even my sensitive ears.

I have so many exciting plans! I'll be a "Gateway Groupie" and communicate with other Gateway users on-line with my modem. (If I'm lucky I'll find a mate through an on-line dating service, and we'll have our own litter!)

That's it. I have to get my own Gateway Family PC. Gee, I wonder if they sell PCs to dogs? I know they accept most major credit cards and C.O.D. terms, with net 30-day terms and leasing options available to qualified commercial customers. I can also apply for the Gateway 2000 DuoLine™ MasterCard® Card, issued by Dial National Bank, Des Moines, Iowa. Oh, and I'll be sure to ask about their "90 Days No Payment" Program!

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Thanks a lot Dr. Nine. You've been a big help. But I won't have time for my weekly appointment anymore — I'll be busy with my new Gateway 2000 Family PC!

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PC Magazine Circle 106 on Reader Service Card

ample, beat our baseline system with the best equivalent upgrade (the Compaq Deskpro/M Pentium/60 Processor Board Upgrade) by 7 percent. Of this roundup's other upgrades, the only one that boosted Winstone performance up to that of a new 486DX/33 system was Evergreen's Rev To 486, which employs a clock-tripling Blue Lightning CPU—an impressive feat considering that the chip was not running at full capacity (it was running at 66 MHz instead of 99 MHz).

A look at the benchmark test results shows that Winstone performance improvements weren't as dramatic as improvements on our processor tests. That's to be expected, and it illustrates one of the fundamental limitations of CPU upgrades: No matter how fast the CPU gets, your overall system performance will ultimately be constrained by other factors, such as a slow hard disk or graphics subsystem. By the time you upgrade those other components to match the faster CPU, you've probably spent as much as it would cost to buy a new machine.

CAVEAT EMPTOR

If you decide you're interested in a CPU upgrade, the first step is to figure out what options are available for your machine (see "Upgrade Options" for more information). But be aware that there are hidden compatibility restrictions associated with almost all of these upgrade solutions. Some common ones:

- Most Intel 386SX/16 chips manufactured before 1991 cannot be upgraded because they lack a "float pin," which allows the upgrade chip to switch off the existing processor. (Kingston makes an upgrade solution specifically for pre-1991 IBM PS/2 Model 55SX systems.) You won't run into this problem, however, with more recent 386SX chips. You can check your system for compatibility by running Cyrix's free SRXTEST.EXE utility, which is available from the company's bulletin board (214-994-8610).
- Module-based upgrades offered by Evergreen and Kingston may not fit in PCs with inadequate clearance. In some systems, you may sacrifice the ability to put full-length expansion boards in some slots after installing a Rev To 486 or 486/Now! board. To avoid hassles, you'll want to check the location of your chip to

■ Power Without the Pitfalls: *10 Steps to the Perfect Upgrade*

Once you've purchased a CPU upgrade, here's how you can ensure that the installation process goes smoothly:

1. Record CMOS settings.

Go to your system's setup screen (often accessed by pressing Del during the boot process) and write down all of the system settings. Be especially careful to note hard disk parameters; without them, you may find that you're unable to access your hard disk after the upgrade is complete.

2. Back up hard disk.

It's unlikely that an upgrade would result in any damage to your data, but to be safe you should back up your hard disk before starting.

3. Create a DOS boot disk.

Format a floppy disk in your A: drive and use the SYS command to make it bootable, in case you can't boot off the hard disk. If you have an EISA- or Micro Channel-based machine, make sure you've got the configuration disks handy. (You may have to move expansion cards to perform the upgrade.)

4. Read the manual and README files carefully.

When it comes to CPU upgrades, it's imperative to look before you leap. Check the manual and README files on installation disks for any hidden caveats.

5. Turn off the machine.

Don't try to install upgrades with the power on.

6. Ground yourself.

Before you touch any electronic components—particularly upgrade CPUs—dissipate any static electricity you've built up by touching a metal surface on the chassis of your system.

7. Note component orientation.

If you're inserting or replacing a processor, make sure you know which pins need to align with which holes in the socket. Pin 1 is usually marked with a notch, paint dot, or the numeral 1. If you have to disconnect any cables during the upgrade, note the orientation of the red wire that indicates pin 1.

8. Be gentle.

If you have to remove a chip, don't use the removal tool like a can opener; you'll bend the CPU's pins. Instead, rock the processor gently out of its socket, using the tool beneath all four sides of the CPU. If you have to insert a chip, don't force it and risk breaking pins.

9. Double-check everything.

Before you put the cover back on, check the orientation of components that you've inserted or moved and make sure all cables have been properly reconnected.

10. Install software.

Install any device drivers needed by the product in CONFIG.SYS and AUTOEXEC.BAT.

see if a board assembly will fit before investing in an upgrade.

In many cases, upgrades that seem as if they should be compatible may not actually work with your system's combination of hardware. Before you buy, ask the manufacturer to provide you with a list of systems that have been tested for compatibility. Intel provides up-to-the-minute compatibility information for its OverDrive processors via a fax-back service

(800-525-3019) or BBS (503-645-6275).

When you're ready to perform the upgrade, check our list "10 Steps to the Perfect Upgrade" to avoid common pitfalls that can make a relatively simple process unnecessarily painful.

After the physical installation of the upgrade is complete, you'll often need to install software such as a memory-resident utility to enable a product's internal cache. Fortunately, these programs con-

sume little system memory—some as little as 64 bytes.

PULLING IT TOGETHER

Our recommendation: If you're really disappointed by your current machine's performance, buy a new PC. Any processor upgrade that will satisfy your desire for speed will be expensive enough to compel you to spend a little more money for a completely new system.

*Chip upgrades
will sustain your PC
until you
buy a new one.*

If you're committed to performing an upgrade because your budget demands it, your best bets are the midrange Compaq processor upgrade cards (for Compaq machines) or some of Evergreen's Rev To 486 products. The products designed to upgrade 486 systems don't provide a sufficient balance of price and performance to make them really worthwhile, although Pentium-based upgrades forthcoming from Evergreen and Intel in the coming months may change this scenario.

A processor upgrade won't turn your PC into an electronic Einstein, but it can raise the level of performance enough for you to appreciate the difference. Think of a chip upgrade not as a panacea but as a bandage—one that will get you through the trauma of dealing with Windows and multimedia while you are awaiting the real cure: a more powerful PC.

Compaq Computer Corp.

• Compaq Deskpro/M Processor Board Upgrades

BY LAURA COX

If you invested in a Compaq Deskpro/M, you can take heart in the fact that upgrades are relatively painless and clearly worth it. Deskpro/M machines have their processors on 32-bit processor cards; by simply replacing an original card with one based on a faster CPU, you can derive

dramatic performance benefits. Short of swapping a motherboard, the Compaq upgrades are as close as you'll get to matching the performance of a brand-new machine. And they're far less of a hassle.

Compaq offers five processor upgrade boards for its Deskpro/M family, starting with an Intel 486SX/25-based board with 4MB of RAM, which is priced at \$399 (Compaq processor board pricing is based on the trade-in value of your system's old processor board). Compaq also sells 486DX/33, 486DX2/50, and 486DX2/66 upgrade boards, plus the only Pentium upgrade on the market today. Users looking at the low-end upgrades will find them substantially cheaper than a new machine, but with complete Pentium systems available from some vendors for under \$2,000, the value of the \$2,299 Pentium upgrade is questionable. Either way, the design of the upgrade boards means you can be sure you're getting near-optimal performance from whatever processor you choose.

The Deskpro/M's modular design lets you plug the processor board into slot 1 of the system's EISA bus board, which acts as the intermediary between the processor board and the card that supplies I/O ports. The processor board contains the CPU, core-logic chip set, clock, and system RAM. (Higher-end boards, beginning with the 486DX2/50 model, have 256K of L2 processor cache as well.) Putting all the componentry on one board makes the upgrade products more expen-

sive than simple processor replacements, but it also reduces the bottlenecks that occur when a fast CPU is mated to a slow, narrow expansion bus.

The Deskpro/M's design also means that you aren't locked into a single upgrade path but can instead choose one that best balances price and performance for your applications. When we upgraded a 386DX/25-based unit with a 486DX2/66 processor board, for example, the machine's performance on our Winstone test more than quadrupled, rising from 11.0 to 47.9. The increase is attributable partly to the faster CPU, but also partly to the 8MB of RAM and 256K of L2 cache installed on the 486DX2/66, as opposed to the 4MB of RAM and no cache on the 386DX/25. When we upgraded the 386DX/25 system with a Pentium/60 board, we saw a fivefold improvement on the Winstone test.

Upgrading is safe, simple, and fast. Once you remove the machine's cover, you simply pull out the old processor board, insert the new one, turn on the machine, and run the EISA configuration utility to update the BIOS. The only obstacle we ran into was having to replace a ROM chip on the I/O board with one that supported the Pentium-class upgrade.

Two of the 486 upgrade boards (the DX2/50 and DX2/66) contain their own Pentium-ready OverDrive socket, so you can upgrade further with a simple chip replacement. Compaq also offers a proprietary memory expansion card (\$188) that adds another 64MB to system memory on 486 models. Pentium/60 upgrade boards have their own on-board memory slots, allowing RAM expansion to 136MB.

Compared with other upgrade options reviewed here, Compaq's processor upgrade boards offer the most complete and effective solution. Your only barrier to entry may be their price, which, depending upon processor speed and additional memory, could easily top the price of a comparable new system.

Cyrix Corp.

• Gx486DRx²

BY ANUSH YEGYAZARIAN

Cyrix Corp. offers a CPU upgrades designed to bring 386-based PCs up to the 486 level. All but extremely novice users should find these upgrades quick and easy to ac-

▶ FACT FILE

Compaq Deskpro/M Processor Board Upgrades (for Deskpro 386DX/25M)

Compaq Deskpro/M 486SX/25 Processor Board Upgrade	\$399
Compaq Deskpro/M 486DX/33 Processor Board Upgrade	\$549
Compaq Deskpro/M 486DX2/50 Processor Board Upgrade	\$1,099
Compaq Deskpro/M 486DX2/66 Processor Board Upgrade	\$1,399
Compaq Deskpro/M Pentium/60 Processor Board Upgrade	\$2,299

In short: These single-board upgrades provide significant performance boosts; they include the system RAM, core logic chip set, system clock, and new CPU. But Compaq's Pentium upgrade may not be cost effective. Compaq Computer Corp.; 800-345-1518; fax, 713-378-1442

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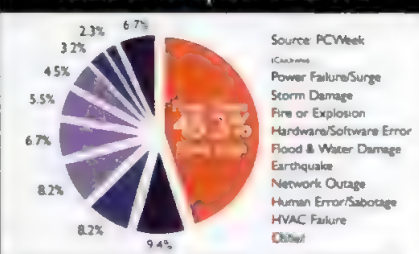
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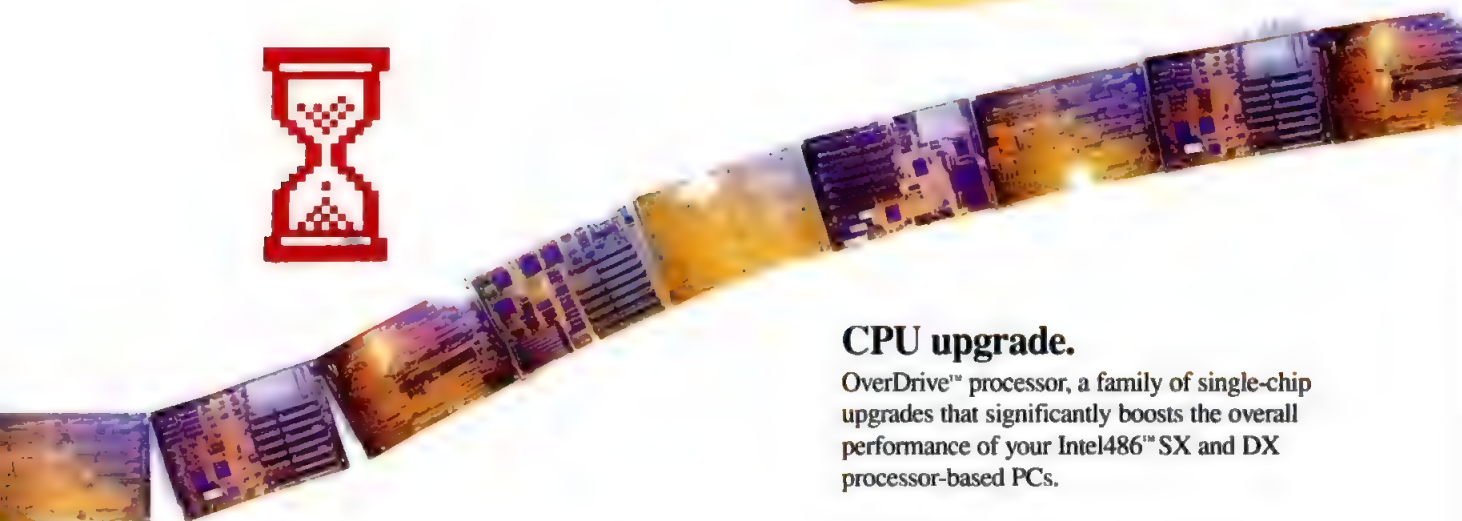
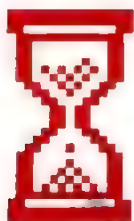
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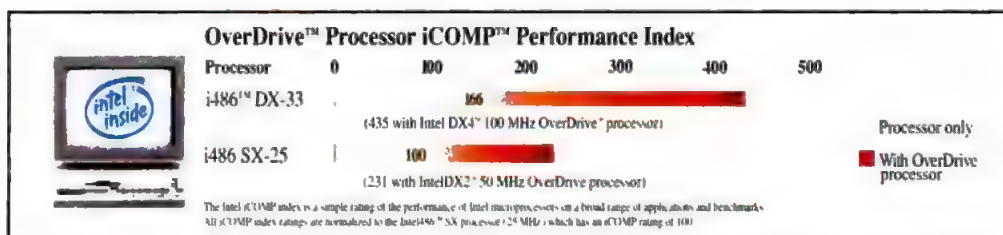
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Upgrade Options: Pros and Cons

Upgrade path	Direct CPU replacement	Proprietary daughtercard	Processor card	Motherboard replacement
How it works	Replaces or supplements the existing CPU with a faster model, often a clock-multiplier.	The CPU (and, optionally, the cache and RAM) is on a replaceable proprietary daughtercard.	The bus-mastering expansion card disables the original CPU.	Replaces the entire motherboard.
Compatible systems	Most systems, except some early 386SX/16 models.	Systems specifically designed to support it.	Systems with the Micro Channel bus (at this time).	Nearly any machine with a standard motherboard.
Improvement in processor performance with tested models	36 to 134 percent.	137 percent to 681 percent.	263 percent.	154 percent.
Cost	\$249 to \$978.	\$399 to \$2,299.	\$495 to \$1,380.	\$495 to \$2,895.
Installation difficulty and time required	Easy: 15 to 30 minutes.	Trivial: 5 to 10 minutes.	Easy: 15 to 30 minutes.	Difficult: 1 hour or longer.
Benefits	Widely available, easy to install (especially if a ZIF socket or an OverDrive socket is on the motherboard).	Excellent performance improvement; easy to install.	Excellent processor-performance improvement; easy to install.	Allows access to new architectures, local buses, and the like.
Limitations	Some 386SX models are not upgradable. The physical design of the system and the size of the upgrade module may prevent upgrade.	A vendor-specific solution; it works only with specially designed systems.	Designed specifically for IBM PS/2 models 55, 56, 57, 65, 70, and 80.	Old RAM may not be compatible. This upgrade can be difficult for some systems and is often expensive.
Overall assessment	Offers a moderate performance benefit, but appropriate if low cost and simplicity are musts.	A solid upgrade solution if you have a system designed for it and are willing to spend.	A good vendor-specific upgrade solution, but pricey.	A hacker's delight, but not practical for mass upgrades in a corporate environment.
Examples	Cx 486DRx ² , IntelDX2 OverDrive chips; Rev To 486, Rev To DX4, 486/Now! modules.	Compaq Deskpro/M Processor Board Upgrades.	MCMaster processor board upgrades.	AMI Super Voyager VLB-III ISA Motherboard, many others.

comply. Upgrading is as simple as pulling out your PC's old CPU and replacing it with the Cyrix part; or, for upgrading SX-based machines (not reviewed here), fitting the new Cyrix chip over your system's existing CPU. Prices range from \$249 (for 40-MHz CPUs) to \$299 (for 66-MHz CPUs). The two products we tested—a 50-MHz and a 66-MHz CPU—demonstrated gains in processor performance of up to 78 percent. If you want to extend the life of your 386, Cyrix's solutions are well worth considering.

We tested two Cyrix upgrade products, the Cx486DRx² 25/50 and the Cx486DRx² 33/66, in a Compaq 386DX/25e and a ZEOS 386DX/33, respectively; each test system had 4MB of RAM. We also received one of Cyrix's upgrade products for 386SX systems but

were unable to obtain a suitable 386SX test-bed. Both of the upgrade chips we tested are clock doublers, with 1K of on-board cache and no floating-point unit.

Cyrix claims that its upgrades will improve your computer's overall performance by over 100 percent. The improvements we observed were not quite that high. The Compaq 386DX/25e with the Cx486DRx² 25/50 upgrade showed its most significant performance increase on our processor test, where we saw a 44 percent rise in the system's results. Winstone and Graphics Winmark scores also rose, by 39 and 41 percent, respectively. The DOSmark score improved by 37 percent, and DOS and Windows disk results rose by about 25 percent each. Interestingly, DOS video results were unchanged.

This pattern remained fairly consistent in the ZEOS test-bed system with the Cx486DRx² 33/66 upgrade. DOS Video results did not change significantly; again, it was the processor test score that showed the greatest improvement: 78 percent. The system's Winstone score rose by only 32 percent. On the Graphics WinMark test, the upgraded system showed a 35 percent improvement. Although the Graphics WinMark score doesn't quite measure up to the gains we found with the Cx486DRx² 25/50 system, the difference in performance is no-

ticeable. DOS Disk and Disk WinMark scores both improved by 35 percent, while the unit's DOSmark score rose 60 percent.

Upgrading the CPU was simple and should take no more than 15 minutes to complete. Once the case is open, all you have to do is remove the old processor with the tool provided and replace it with the Cyrix upgrade. (For 386SX upgrades, you must fit the chip over the existing one). In either case, documentation in the manual is complete, walking you through the upgrade process.

Once you have installed the CPU, your system should be functional. All that remains is to install the software that enables the on-chip cache, which can be done quickly in either DOS or Windows.

Cyrix adds two nice touches to make the upgrade process easier: The first is a list, at the front of the manual, of companies whose systems are compatible with Cyrix products (not an exhaustive list, but fairly complete nonetheless). The second is a verification program that users can access through Cyrix's on-line bulletin board system; just download the program and run it to find out if your particular system will work with the Cyrix upgrades (Cyrix's BBS number is 214-994-8610).

Though these chips are available directly from Cyrix, most are purchased through resellers, superstores, and catalogs. Cyrix offers direct service for all of its products. The company does provide a limited lifetime warranty and may replace a defective part at its discretion, although all returns are handled at the reseller level. Large installations may be handled through Cyrix directly. Cyrix technical support is available to all purchasers for the life of the product as well.

Cyrix targets mainly small-office or home-office users who are wondering when and how to handle their next system purchase. Cyrix claims its upgrade could extend the life of a system by an additional 18 months. The upgrades are among the most affordable on the market; they're easy to perform; and there are definite performance benefits. If you're considering an upgrade to improve your 386's performance, this may be the one for you. But since these upgrades do not measure up to true 486 system performance, you will have to consider where your money is best spent.

▶ FACT FILE

Cx486DRx²

Cx486DRx² 25/50 (for 386DX/25)\$249
Cx486DRx² 33/66 (for 386DX/33)\$299

In short: Cyrix's upgrades are among the most affordable on the market and yield definite performance benefits, although they do not quite measure up to true 486 system performance. Installation is quick and straightforward enough to be handled by a novice.

Cyrix Corp., 800-848-2979; fax, 214-699-9857.

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Benchmark Tests: CPU Upgrades

Results on our benchmark tests demonstrate that the impact of a CPU upgrade will be limited by the older, slower components in your system: Winstone scores don't increase by nearly as much following an upgrade as processor scores. Most upgrades won't give you overall performance comparable with that of new entry-level machines. The most effective upgrades replace not just the CPU but the memory subsystem as well.

What the Numbers Mean

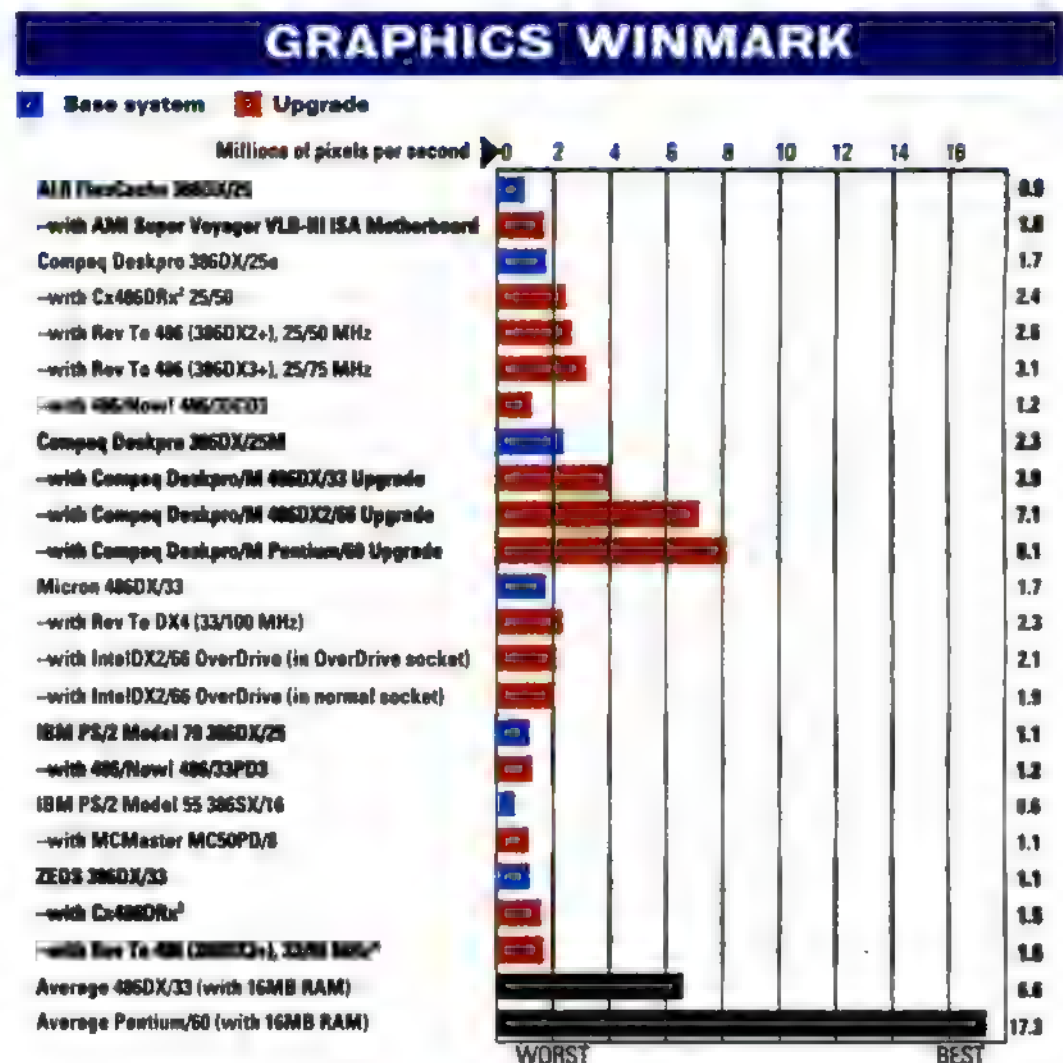
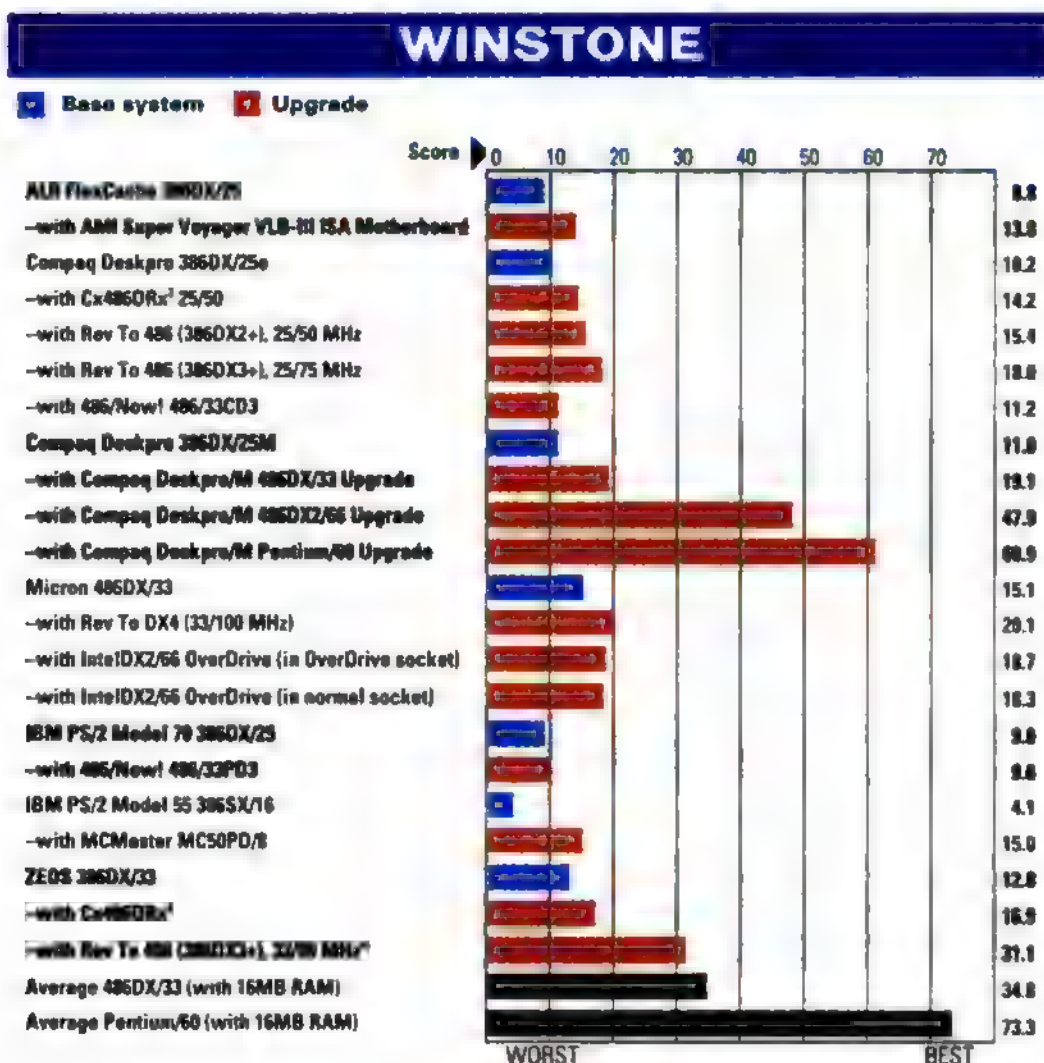
Compaq Computer Corp.'s proprietary processor cards are the upgrades that can come closest to making your existing PC perform like a new system. The ample real estate on these processor boards allows Compaq to include L2 cache (on the 486DX2/50, 486DX2/66, and Pentium/60 models only) and memory on the board; the inclusion of cache avoids a crucial bottleneck that hinders most other CPU upgrade solutions. Upgrading our base Compaq Deskpro 386DX/25M system with a Pentium/60 processor card resulted in an astounding fivefold improvement—from 11.0 to 60.9—on our Winstone test, which is indicative of performance under popular Windows applications. But even 60.9

falls short of the performance score provided by many new Pentium/60 systems.

The Compaq Deskpro/M Pentium/60 Processor Board Upgrade includes 8MB of RAM and a 256K L2 cache, as does the Compaq Deskpro/M 486DX2/66 Processor Board Upgrade that we tested. The Compaq Deskpro/M 486DX/33 Processor Board Upgrade (which has only 4MB of RAM) provided far less impressive improvements on our Winstone test, scoring only 74 percent higher than the base system—a 386DX/25 with 4MB of RAM and no cache.

Again, the improvement we observed in Winstone scores did not match the improvements we saw in processor scores. Upgrading a Compaq Deskpro 386DX/25M with the Pentium/60 processor board, for instance, resulted in a processor score that was seven times as high but in a Winstone score that was only five times as high. This discrepancy—one by no means unique to this particular upgrade—is again a result of the faster CPU being constrained by the older, slower components in the system.

Kingston Technology Corp.'s series of MCMaster processor cards, which have a design similar to that of the Compaq boards but are specifically manufactured for the IBM PS/2 Models 55, 56, 57, 65, 70, and 80, showed their muscle as an upgrade option as well. The card we tested, which is powered by an AMD 486DX2/50 processor and 8MB of on-board RAM (total system RAM of 12MB), more than tripled the Winstone score of the 386SX/16-based IBM PS/2. The processor score was tripled as well. Despite all the added memory, though, the post-upgrade processor scores still fell short of those achieved by even the lowliest new 486SX system.



CHIP UPGRADES

Direct CPU upgrades, which plug into either a CPU socket or a coprocessor socket on the motherboard, don't have the advantage of adding L2 cache and more RAM. As a result, the performance increases they provide are more modest than those offered by plug-in CPU boards.

The IBM Blue Lightning chip on Evergreen's Rev To 486 (386DX3+) upgrade board, when placed in the base system—a ZEOS 386DX/33—allowed this unit to rocket pass the competition. (The diminutive upgrade board converts the pinout of the Blue Lightning CPU to that of the 386DX it's designed to replace.) The Evergreen product, which has a true 486 design and 16K of internal write-back cache, easily outdistanced its competitors on Winstone tests.

We did run into some problems, however. When we installed the Rev To 486 (386DX3+) upgrade in our ZEOS 386DX/33 base system, we were unable to complete our Winstone tests with the CPU running at full speed—a reminder that there's no guarantee that CPU upgrades will work with every system. Timing problems and, possibly, insufficient heat dissipation are likely culprits.

Evergreen's documentation states that some machines may be incompatible with the upgrades and recommends disabling the CPU cache or slowing down the processor as possible remedies. After reducing the CPU's speed to 66 MHz (by setting it to clock-double instead of clock-triple), we were able to generate the results shown here. The system's Winstone score more than doubled, as did its processor score. These scores put the upgraded system in the same performance range as a low-end 486 machine.

Results of a 25-/75-MHz Rev To 486 (386DX3+) upgrade in a Compaq Deskpro 386DX/25e system were also impres-

sive. (In the Compaq testbed, we had no trouble running the chip at its full clock-tripling speed.) The Winstone score increased by 76 percent; the processor score more than doubled.

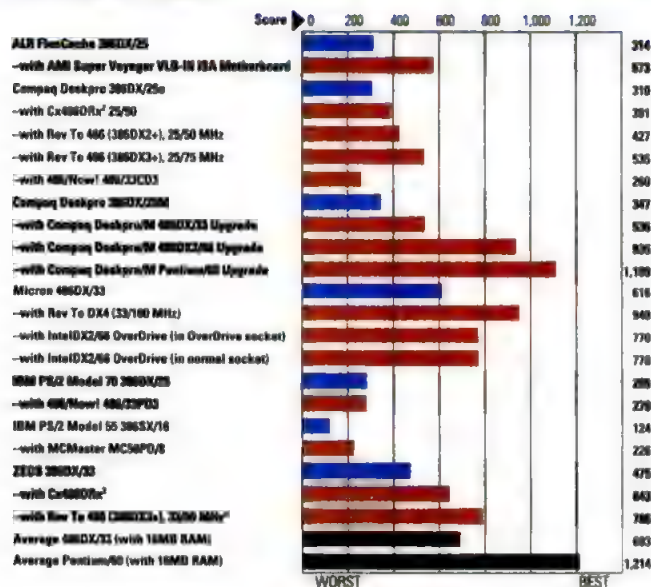
Another Rev To 486 offering from Evergreen is based on a Texas Instruments 486SXL2 (25/50 MHz) CPU. The TI chip, which has 8K of cache, a 486 core, and a double-speed clock, was able to improve the base system's processor score by 61 percent, its Winstone score by 51 percent—not enough to bring the unit's performance into the realm of that achieved by 486 machines.

The performance of Evergreen's Rev To DX4 upgrade, which we tested in a Micron 486DX/33 machine, was less impressive. Although it helped to increase the processor score of the base system by 85 percent, the system's Winstone score was boosted by only 33 percent. The scores for the upgraded system were low compared with the average score of DX4/100 systems that we have tested in the past—although new DX4/100 systems typically have more memory than the Micron base system, which had 4 MB.

Other chip upgrades didn't fare as well. The clock-doubling Cyrix upgrade chips are 486-compatible but have only 1K of combined instruction/data cache on the chip, which means that the slower L2 cache (if the system has one) is still quickly called upon in the upgraded systems. Cyrix's Cx486DRx² upgrades increased the processor score by 44 percent in the 25-MHz Compaq base system and by 78 percent in the 33-MHz ZEOS base system. Winstone performance improvements were lower: 39 percent for the Compaq system and 32 percent for the ZEOS system. These upgrades aren't sufficient to propel the machines' overall performance into the performance range of an average 486SX/33.

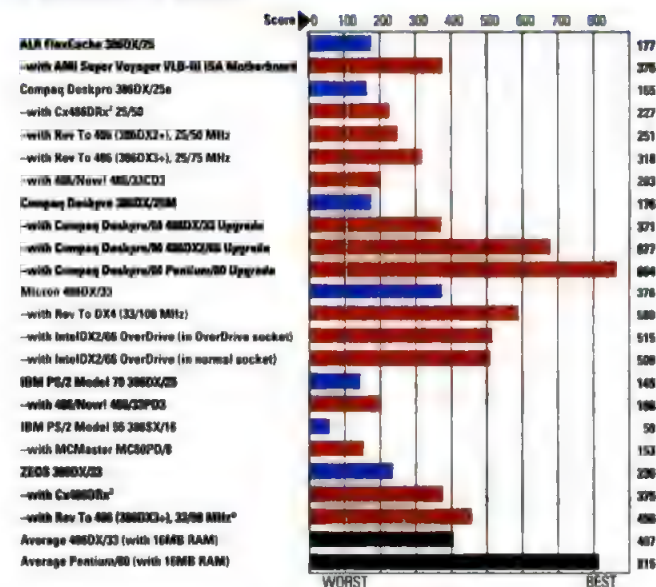
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Benchmark Tests: CPU Upgrades

Kingston's hybrid chip/adaptor upgrade solutions, the 486/Now! 486/33CD3 and the 486/33PD3, both use an AMD 486DX/40 chip that, strangely enough, has a 33-MHz clock running it. This upgrade is specific to a handful of Compaq Deskpro systems (486/33CD3) as well as IBM's PS/2 Models 70, P70, and 80 (486/33PD3). Like most of the upgrades here, they will run at any processor speed up to their rated 33 MHz. The 486/Now! 486/33CD3, which uses 8K of internal cache and no clock doubling, (and is used to upgrade a Compaq Deskpro 386/25e) turned in the poorest performance on our processor tests, increasing the base system's processor score by only 36 percent. On our Winstone test, the base system's score increased by a mere 10 percent.

The IntelDX2 OverDrive upgrade CPUs come in two different physical packages, one with an extra pin for machines with a dedicated OverDrive socket and one with a standard 486 pinout that replaces socketed CPUs directly. Both upgrades incorporate the same fundamental circuitry—that of a clock-doubling 486DX2 chip. And when we tested both we observed no significant difference between test scores. Upgrading a Micron 486DX/33 system with an OverDrive processor resulted in roughly a 55 percent improvement in processor score and a 23 percent improvement in Winstone score.

MOTHERBOARD REPLACEMENTS

A nearly infinite number of upgrade scenarios are possible when you replace a system's entire motherboard, so we've

printed the results for just one such scenario here. The performance of a motherboard upgrade is as unpredictable as the performance of a new system: It depends on a combination of CPU; L2 cache size, speed, and architecture; memory size; chip set manufacturer; and I/O bus. The results depicted here are for an AMI Super Voyager VLB-III ISA Motherboard with a 486DX/33 CPU, 256K of 20-ns asynchronous write-back L2 cache, 8MB of RAM, and an AMI chip set.

Because even replacing the motherboard leaves you with outdated peripherals (the hard disk and often the graphics card), you won't see the same level of performance you would get from a new machine. The 13.8 Winstone score, for example, of the system whose motherboard we replaced was lower than that of a typical 486SX/25 system.

Because motherboard upgrades still leave you with old peripherals, upgraded PCs under-perform new ones.

SUBSYSTEM RESULTS

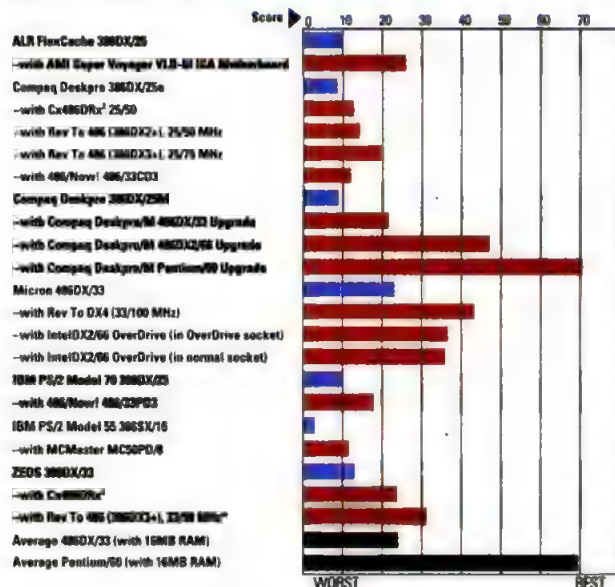
Upgrading your processor will typically have a positive effect on all the subsystems of your PC as well. With better

processor scores you should also get better disk, video, and DOS performance. Because the different base systems used for our tests contained different componentry, direct performance comparisons cannot be made.

DOS video scores were the least affected by the processor upgrades. The Compaq Deskpro/M 486DX2/66 Processor Board Upgrade was able to increase DOS video performance by only 11 percent; most upgrades didn't enhance performance in this area at all; and, in fact, all the upgrades from Kingston and Intel resulted in lower scores—some were as much as 9 percent lower—on our DOS video test.

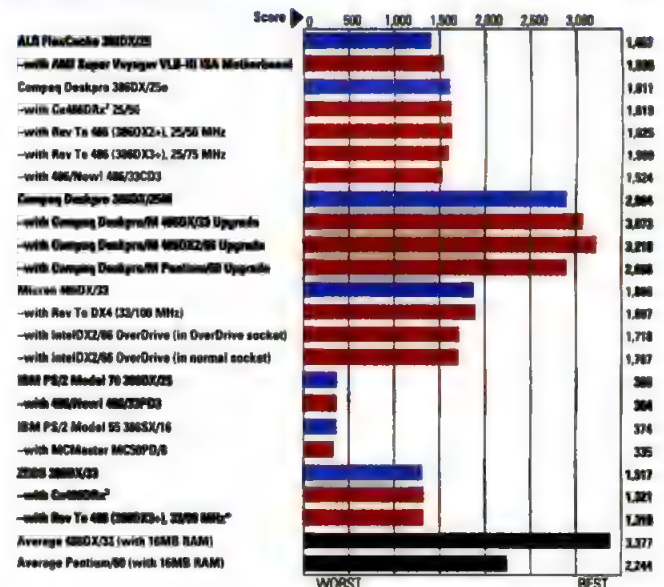
PROCESSOR

■ Base system ■ Upgrade



DOS VIDEO

■ Base system ■ Upgrade

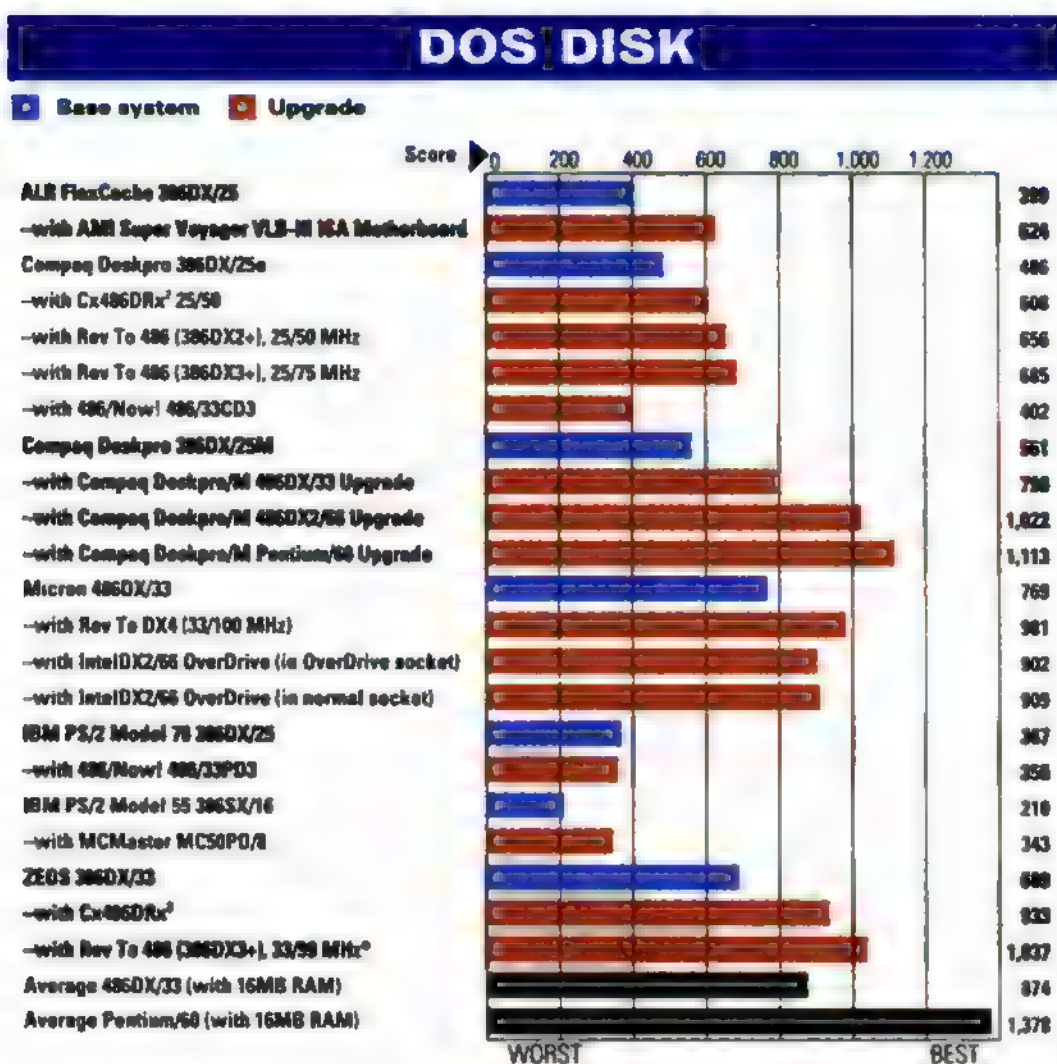


DOS disk performance showed modest improvement across with most upgrades. Boosted by L2 cache and extra memory, Compaq's Pentium/60 processor board led the pack, nearly doubling the performance of the Compaq Deskpro 386DX/25M base system. Since graphics performance was largely unaffected by the component swap, the DOSmark scores—which indicate overall DOS performance—mirrored DOS disk performance gains resulting from upgrades. Again, Compaq's Pentium/60 processor board led the way, resulting in a DOSmark score that was nearly five times as high as that of the base system.

In addition, Graphics WinMark and Disk WinMark test scores were higher among those base systems whose upgrades involved more than just a processor. Compaq's processor boards, Kingston's MCMaster upgrades, and our AMI motherboard upgrade resulted in the greatest increases in these scores. These upgrades, which involved additional L2 cache and memory, showed that it takes more than a faster processor to give you big gains in Windows performance. Leading the way once again was Compaq's Pentium/60 processor card, which more than tripled both the Graphics WinMark and Disk WinMark scores of the base system. Showing its prowess as a chip-only (it has no L2 cache or memory) upgrade, Evergreen's Rev To 486 (386DX3+) that we installed in the Compaq Deskpro 386DX/25e increased the Disk WinMark score by 73 percent and the Graphics WinMark score by more than 80 percent.

Finally, remember that components themselves can give you a large performance boost. Upgrading to a 64-bit graphics card and an enhanced IDE hard disk can amplify the performance you see in all your applications.

—Analysis by Richard Fisco



How We Tested

To test these CPU upgrades, we dusted off some old PCs that we had in the labs and tried to recreate common configurations that a user might still have. We tested using a variety of baseline units equipped with 4MB of RAM: a Compaq Deskpro 386DX/25e with a 300MB Imprimis ESDI hard disk and Compaq's own on-board graphics; a Compaq Deskpro 386DX/25M with a 340MB Conner IDE hard disk and a Compaq Q-Vision graphics card; a Micron 486DX/33 with a 340MB Maxtor IDE hard disk and an Orchid ProDesigner III graphics card; an IBM PS/2 Model 55SX, a 16-MHz 386SX-based system with a 114MB IDE hard disk and an IBM proprietary graphics subsystem; an IBM PS/2 Model 70, a 25-MHz 386DX-based system with a 114MB IDE hard disk and an IBM proprietary graphics subsystem; and a ZEOS 386DX/33 with a 340MB IDE hard disk and a Diamond SpeedSTAR graphics card.

We also performed a motherboard upgrade on an ALR FlexCache 386DX/25. The ALR FlexCache was configured with 4MB of RAM, a 152MB CDC ESDI hard disk, and an Orchid ProDesigner IIS 1MB graphics card. We used an AMI Super Voyager VLB-III ISA Motherboard as the replacement.

We loaded MS-DOS 6.2 and Microsoft Windows 3.1 on all machines, set SmartDrive to its default, let Windows suggest the size of the swapfile, and enabled 32-bit disk cache on those systems that allowed us to do so. During tests using the Compaq Deskpro 386DX/25e and the IBM PS/2 Models 55SX and 70, Windows was set to a 640-by-480 resolution with 16 colors at a refresh rate of 60 Hz. All other systems were set to 800-by-600 resolution with 256 colors at a refresh rate of 60 Hz.

After performing each upgrade, we used the manufacturer's supplied utilities to ensure that the upgrade chip's cache was enabled.

In preparing this issue, we used PC Bench 8.0 to test processor, video subsystem, and disk performance using DOS applications. The DOSmark is a summary of those three results and estimates system performance under DOS. We also used WinBench 4.0 to obtain Graphics WinMark and Disk WinMark scores, and we used the application-based Winstone 94, Version 1.0, to determine overall system performance under Microsoft Windows 3.1.

Winstone 94, Version 1.0, measures the time a PC takes to execute a set of application scripts that exercise 12 Microsoft Windows 3.1 applications. We normalize Winstone scores relative to a 386DX/25-based Compaq Deskpro/M with 4MB of RAM, which has a Winstone score of 10. The Winstone scores let you compare overall system performance under Windows.

The **Graphics WinMark** score is a measure of PC graphics performance under Windows 3.1. We run 66 different tests to evaluate each system's handling of the Windows GDI (Graphics Device Interface). These tests are based on extensive application profiling.

The **Disk WinMark** score reflects disk subsystem performance under Microsoft Windows. The tests use different files and file operations in a blend based on extensive profiling of applications' disk usage.

The **processor** score reflects CPU, RAM, and RAM cache performance. It is based on a large instruction mix and either the floating-point coprocessor test or the floating-point emulation test, depending on whether the PC has a coprocessor.

The **DOS video** score is a weighted harmonic mean of tests that measure 8- and 16-bit VGA write operations involving both text and graphics.

The **DOS disk** score gauges the performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. Our tests use more than 100 files in six directories totaling over 30MB. The operations performed include file reads, file writes, file creation, and file deletion.

The **DOSmark** score is a composite rating derived from the processor, DOS video, and DOS disk scores.



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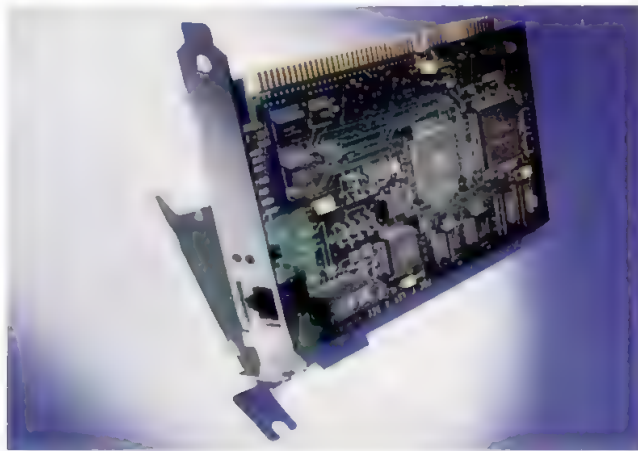


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Evergreen Technologies Inc.

- **Rev To DX4**
- **Rev To 486**

BY ANUSH YEGYAZARIAN

Evergreen Technologies makes CPU upgrades for most 286, 386, and 486 systems, providing the widest range of upgrade options of any company reviewed here. The company's Rev To 486 offerings, which upgrade 286, 386SX, and 386DX CPUs using 486 processors from IBM and Texas Instruments, yielded noticeable performance increases on our Winstone application-based tests—as much as 140 percent. List priced from \$229 to \$799, the Rev To 486 products will appeal to users who invested heavily in 386 machines and want to postpone an investment in new systems.

Evergreen's Rev To DX4 upgrades for 486-based systems turned in more modest performance improvements; at \$878 (for 25-MHz systems) or \$978 (for 33- and 50-MHz systems), they're a less compelling buy. The company sells all its products through resellers and distributors, typical-

ly at prices of \$25 to \$100 below list.

Evergreen's upgrade products come in two formats: a simple processor replacement, and a kind of "processor platform" that includes additional circuitry on a half-inch-thick adapter and voltage converter. Both types of upgrade are quick and easy and could be performed by near-novice users. A minor shortcoming of the products: documentation that is sometimes unclear.

386 UPGRADES

For 386 systems, Evergreen provides three options: a clock-doubling TI 486SXLC2 processor for 16-, 20-, and 25-MHz machines; clock-doubling IBM 486SLC2 processors for 25-MHz and 33-MHz machines; and clock-tripling IBM Blue Lightning processors for 16-, 20-, 25- and 33-MHz machines. The TI processors have 8K of internal cache; the IBM processors, 16K. None of the upgrades includes a floating-point coprocessor, although the motherboard's coprocessor socket can still be used.

Evergreen's upgrades for 386DX systems include the IBM Blue Lightning (33/99 MHz) CPU that we tested in a ZEOS 386DX/33 system and in a Compaq 386DX/25e with 4MB of RAM. On our Winstone test, we were unable to run the Evergreen product at the full 99 MHz in the ZEOS unit and had to reduce its clock speed to 66 MHz to get it to complete the test. Running at that speed, we observed a 143 percent improvement in performance under Windows. The Blue Lightning (33/99) was also tested with the Compaq 25-MHz system, successfully tripling the clock-speed to 75-MHz. Though it's a less dramatic improvement than the one found in the ZEOS, the upgrade managed to nearly double the Compaq's performance on both Winstone and DOSmark tests. When we tested Evergreen's TI 486SXLC2 25/50 upgrade on the Compaq 386DX/25e, it yielded a 51 percent boost in Windows performance.

486 UPGRADES

Evergreen's Rev To DX4 CPU upgrade is the first product of its kind; as we wrote

this, Intel had not yet released its DX4 OverDrive processor. Later this year, Evergreen will also begin shipping its first Pentium-based upgrade.

The DX4 upgrade (an Intel processor with a voltage converter) was tested using a 486DX/33-based Micron with 4MB of RAM; it improved the Micron's baseline results by roughly 35 percent on our Winstone tests.

If you invested in a 386-based system and want to extend its life, try Evergreen's Rev To 486 upgrades.

SIMPLE INSTALLATION

All of the Evergreen products were fairly easy to install. Most were done in about 15 minutes, not including the time it takes to leaf through the manual. First you pull out the original CPU with the tool

provided, then insert the replacement unit. For the Rev To 486 upgrades, the Evergreen supplies an easily installed caching program to enable the processor's on-board cache. In the case of the IBM Blue Lightning upgrades, you'll probably also want to change CONFIG.SYS so that the processor works as a clock-tripler rather than defaulting to the clock-doubler setting.

The only part that made these upgrades even a little tricky was Evergreen's manuals, which contain some minor errors and discrepancies. The most significant oversight was with the Rev To DX4 processor: The manual doesn't explain how to connect the CPU fan to the power supply, which could be puzzling for inexperienced users.

Along with the caching software, Evergreen includes software to check for the feasibility of 386SX upgrades. The manual has clear pictures showing what to look for and which Intel or AMD chips allow you to use its upgrade products. Evergreen also makes socket rotation adapters in case the orientation of Pin 1 and the position of surrounding components makes its upgrade difficult to fit.

If you made an investment in 386 systems and want to extend their life for another 12 to 18 months, the Evergreen Rev To 486 upgrades merit serious consideration. At present, the Rev To DX4 upgrades hold less appeal.

▶ FACT FILE

Rev To 486 and Rev To DX4

Rev To 486 list prices:

Rev To 486 (386DX2+) (TI 486SXLC2 for 386DX/16 or 386DX/20)	\$229
Rev To 486 (386DX2+) (TI 486SXLC2 for 386DX/25)	\$279
Rev To 486 (386DX2+) (IBM Blue Lightning for 386DX/33)	\$549
Rev To 486 (386DX3+) (IBM Blue Lightning for 386DX/16 or 386DX/20)	\$449
Rev To 486 (386DX3+) (IBM Blue Lightning for 386DX/25)	\$549
Rev To 486 (386DX3+) (IBM Blue Lightning for 386DX/33)	\$799

Rev To DX4 list prices:

Rev To DX4 (25/75 MHz) (for 486SX/25 or 486DX/25)	\$878
Rev To DX4 (33/100 MHz) (for 486SX/33 or 486DX/33)	\$978
Rev To DX4 (50/100 MHz) (for 486SX/50 or 486DX/50)	\$978

In short: Evergreen's Rev To 486 upgrades for 386-based machines provide Winstone performance improvements of 30 to 40 percent at a reasonable cost. The Rev To DX4 upgrades for 486-based systems do not offer as much of a price/performance improvement. Installation of these upgrades is straightforward.

Evergreen Technologies Inc.; 503-757-0934; fax, 503-757-7350.

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PCs
CPU Upgrades

Intel Corp.

• IntelDX2 OverDrive

BY ROBERT S. ANTHONY

As processor upgrades go, Intel Corp.'s IntelDX2 OverDrive processors are well-suited for PC users with short tempers or brief attention spans. OverDrive chip upgrades are essentially five-minute jobs and are so straightforward and painless that even novices should have no trouble. OverDrive processors are available for most 486SX and 486DX systems; simply by doubling your original CPU's clock speed, they provide modest performance improvements of about 20 percent, according to our applications-based tests. But given the cost of that boost in power—\$249 to \$299 for the products we tested—you might do better to save up for a more significant upgrade later.

As we went to press, Intel had just announced its DX4 OverDrive processors, which triple rather than double clock speed. Later this year, you can expect to see the much-awaited Pentium-based OverDrive processor, too.

OVERDRIVE OPTIONS

OverDrive chips come in a variety of flavors; which one to get depends on the type of motherboard installed in your PC. Many motherboards have an empty upgrade socket specifically designed to accommodate OverDrive chips; in these systems, the installation process is as simple as inserting an OverDrive processor into the socket. The OverDrive CPU automatically disables the original CPU. For PCs without an upgrade socket, Intel offers a line of essentially identical OverDrive chips that can replace your current CPU. You just use

a chip-removal tool (provided with all OverDrive processors) to extract your existing processor and insert the replacement. If your processor is seated in a ZIF (zero insertion force) socket, you won't even need the extraction tool; just pull on the lever to pop the original chip out.

Intel offers an automated fax-back service (800-525-3019) so you can determine which OverDrive chip is correct for your PC.

Today's OverDrive chips are essentially 486DX2 processors, so installing one merely doubles the internal clock speed of the processor and adds a floating-point coprocessor (if you previously had only a 486SX). In our tests of OverDrive processors in a Micron 486DX/33 system with 4MB of RAM, we found that performance improvements were minimal. While scores on our processor tests increased by around 50 percent following the upgrade, the Winstone test score—which is a better measure of perceived improvement because it tracks performance of real Windows applications—increased by only about 20 percent. That's clear proof that there is more to upgrading a PC than just improving its processor.

TRIVIAL INSTALLATION

Installation of OverDrive chips is about as easy as upgrades get, although the on-line tutorial provided with the upgrades offers dire warnings and recommends that a "qualified technician" install the chip. Really, about all there is to the process is making sure that you orient the upgrade CPU properly, which means ensuring that you line up the key pin on the OverDrive chip with the matching hole in the socket. One caveat: The pins on the chips are easily bent, so don't use the chip removal tool as if it were a can opener. If you have any doubts about the upgrade procedure, you can watch the animated tutorial that Intel provides.

Intel refers to its OverDrive chips as "the most innovative CPU upgrade available," but calling them "the simplest upgrades available" might be more apt. The question is, Does the performance improvement really justify the investment? For most 486 users, the answer will be a resounding no.

Kingston Technology Corp.

• 486/Now!

• MCMaster

BY ROBERT S. ANTHONY

Kingston Technology offers a smorgasbord of processor upgrades. We looked at three products, all of which proved easy to install: two \$425 members of the 486/Now! series, each of which plugs directly into a 386DX CPU socket of a compatible system (at this time, these upgrades are specifically designed for IBM and Compaq systems only), and one \$995

*Kingston Technology
offers many CPU up-
grades, including Micro
Channel-based products
for IBM PS/2s.*

MCMaster CPU upgrade with 8MB of RAM for MCA-based IBM PS/2 Models 55, 56, 57, 65, 70, and 80. All are a bit pricey for the performance gains that we observed, but if you need to prolong the life of your PC, you may choose to consider them.

486/NOW!

Kingston's 486/Now! upgrades are small daughterboards that are pin-compatible with 386DX CPU sockets of compatible PCs. Using one of these boards to upgrade an IBM PS/2 requires no driver software (drivers were required to upgrade the Compaq systems tested). Since these upgrade boards can be used with motherboards of various speeds, a DIP switch on the board may need adjusting.

We installed a 486/Now! 486/33PD3 board in an IBM PS/2 Model 70 and a 486/Now! 486/33CD3 board in a Compaq Deskpro 386DX/25e. Both machines originally came with a 386DX/25 CPU and 4MB of RAM; each upgrade board came with an AMD 486DX/40 CPU. You must remove the original CPU and the math coprocessor (if any) to use the 486/Now! unit. A chip-removal tool and illustrated documentation are provided.

▶ FACT FILE

IntelDX2 OverDrive

IntelDX2/50 OverDrive (for 486SX/20, 486SX/25, 486DX/20, 486DX/25)\$249

IntelDX2/66 OverDrive (for 486SX/20, 486SX/25,

486DX/33)\$299

In short: While the IntelDX2 OverDrive upgrades are very easy to install, the overall performance boost they provided was relatively minor, making these chips a questionable investment.

Intel Corp.; 800-538-3373, fax back, 800-525-3019

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■ Motherboard Swap: *Yes or No?*

By William P. Flanagan

If you want to squeeze the most performance out of your existing system, a processor-only upgrade may not be enough. In most cases you'll still be saddled with a slow memory subsystem and similarly outdated componentry. One solution to that problem can be a motherboard upgrade. Be forewarned, however: A Surgeon General's warning on the upgrade motherboard really ought to read, "Attempting to swap a motherboard is not for the faint of heart."

If your business only uses a few PCs, a motherboard swap may be a feasible option. But for most businesses looking to upgrade, it may not be realistic to shut down a large number of systems for a project that could take from an hour to a day per machine. For the sophisticated home user, however, that option may be more realistic.

BEFORE YOU DECIDE

When the industry was building 386 systems in the mid- to late 1980s, there were no 486s; as a result, many of these systems were never designed to facilitate a motherboard swap. Before you consider buying a replacement motherboard, take a close look at your system. Can you get to the motherboard without performing contortions? Will your current components work with the new motherboard, or will you need to toss out that ESDI hard disk and VGA adapter?

You'll also need to ask whether it's cheaper to buy a new motherboard or to purchase a completely new system. Replacement motherboards can easily cost \$500 or more (including the CPU). And in most cases, you won't get the benefit of the larger hard disk and speedier, higher-resolution video that typically come with a new machine. Consider the value of your time, and make sure you're really qualified to perform major

surgery on your machine.

The performance benefit you'll observe from a motherboard swap depends on the system you're upgrading and the new motherboard that you use. When we upgraded an ALR Flex-Cache 386DX/25 system to a 486DX/33 motherboard from AMI (800-828-9264), the unit's processor score jumped 150 percent, and its DOSmark score more than doubled. The performance improvement we observed in Windows applications was not as great but was still very respectable. The Winstone score went up by 57 percent, while Graphics and Disk WinMark scores increased by around 80 percent, respectively. System performance under Windows is heavily influenced by hard disk speed and RAM capacity, so simply swapping motherboards won't eliminate bottlenecks imposed by older components.

TAKING THE PLUNGE

If you decide that a motherboard upgrade is for you, don't just grab a screwdriver and dive right in. Go slowly and document everything. Assume nothing—take note of the positioning of all cables and wires and look to see where each counterpart is located on the new motherboard. Label each cable so you know where it came from and where it has to go.

Your starting point should be to turn the system on and enter the system's BIOS configuration utility (usually by pressing Del or F10 during the boot process). Write down the individual settings of all items, paying close attention to the hard disk drive. Without this information, the process will be extended indefinitely because the new motherboard's BIOS may not be able to recognize your disk, meaning you'll spend an afternoon on the phone with the hard disk manufacturer getting information that was readily

available to you. We were fortunate that the AMI motherboard we used included a BIOS utility to set the drive parameters automatically.

Removing the motherboard typically involves unscrewing one or two screws that hold it down, then simply sliding it out. Replace original controller cards and reconnect the LED, speaker, and fan connections to the motherboard. Connect the motherboard itself to the power supply. Finally, reconnect the hard disk and floppy disk cables to the controllers.

A couple of things to watch out for: If your original motherboard did not have integrated I/O, but your new one does, you may not want to insert your old serial/parallel I/O card to help avoid conflicts. Our system had an ESDI hard disk, so we had to use the original controller card instead of taking advantage of the integrated IDE controller.

WHERE TO TURN

There are a number of places that can get you a motherboard upgrade—almost any computer magazine will have some ads. If you have IBM systems and need to keep the Micro Channel architecture, you might want to check Reply Corp. (800-955-5295), which specializes in bringing old IBM PCs into the mid-1990's. Their motherboard upgrades range in price from \$495 to \$2,895. Motherboard Warehouse (800-486-9975) offers upgrades for any system through their Cymax kits. The kits range in price from \$244 to \$481, for 486SX/25- to 486DX2/66-based systems, respectively, and offer an ISA/VL-Bus combination. Pricing does not include RAM. DataExpert (800-328-2397) will also sell you a motherboard upgrade, with prices raging from \$450 to \$650. Micronics doesn't sell many of their motherboards directly to end users for an upgrade, although you can find them from dealers. □

PCs CPU Upgrades

If you've ever opened up an IBM PS/2, you already know how easy it is to do. Even though you need to remove the hard disk, floppy disk drives, speaker assembly, drive connector board, and a large plastic tray from the IBM PS/2 Model 70 before you can reach the CPU, the IBM PS/2's modular design makes this a tool-free, less-than-5-minute procedure.

On the Compaq unit, accessing the processor socket was also simple because the drive bay assembly is hinged and easily swings out of the way. But with the Compaq units, you need to insert the provided paper insulator under the upgrade board to prevent it from shorting out.

Once the pins were aligned, inserting a 486/Now! board into the CPU socket

was easy. The new CPU was recognized once each unit was turned on after upgrading.

Both 486/Now! upgrades yielded disappointing improvements in scores on our DOS-based tests. For both units, the Disk

WinMark, DOS video, and DOS disk scores actually dropped after the 486/Now! boards were installed. The Graphics WinMark score for the Compaq unit dropped also, but it rose slightly for the IBM unit. For both systems, the Winstone scores crept up by less than 10 percent but,

not surprisingly, the biggest performance boost was reflected in the processor score, which jumped by 79 percent in the IBM unit and by 36 percent in the Compaq unit.

Even though installing the 486/Now! upgrades requires you to remove numerous components, the PS/2's design makes it a simple procedure.

► FACT FILE

486/Now!

486/Now! 486/33PD3 (for IBM PS/2 Models 70 and 80).....	\$425
486/Now! 486/33PS3 (for IBM PS/2 Models 70 and 80).....	\$295
486/Now! 486/33CD3 (for Compaq Deskpro systems).....	\$425
486/Now! 486/33CS3 (for Compaq Deskpro systems).....	\$295
486/Now! 486/33PD3-P70 (for IBM PS/2 Model P70).....	\$425
486/Now! 486/33PS3-P70 (for IBM PS/2 Model P70).....	\$295

MCMaster (for IBM PS/2 Models 55, 56, 57, 65, 70, and 80)

MCMaster MC33PS/0.....	\$495
MCMaster MC33PS/4.....	\$645
MCMaster MC33PS/8.....	\$825
MCMaster MC33PS/16.....	\$1,155
MCMaster MC50PD/0.....	\$695
MCMaster MC50PD/4.....	\$855
MCMaster MC50PD/8.....	\$995
MCMaster MC50PD/16.....	\$1,380

In short: Kingston's 486/Now! and MCMaster CPU upgrades are easy to install, but only the MCMaster MC50PD/8 board, with an assist from 8MB of on-board RAM, provided a truly significant performance boost. Kingston Technology Corp., 800-835-6575; fax, 714-435-2699

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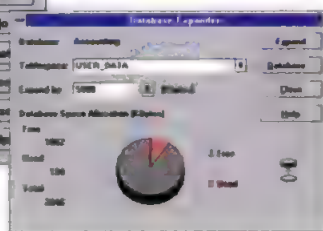
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RAD TOOLS

RADical Development

By David S. Linthicum

Rapid Application Development (RAD) sounds like every client/server developer's dream. Don't we all want a way out of endless development cycles, especially when they yield applications that end users wind up hating?

In the pre-GUI era, RAD began as a formal statement of a highly iterative approach to software development. Its essence was the concurrent management of analysis, design, prototyping, and coding tasks. Today, as a vision of turbocharged development, RAD is more a warm and fuzzy concept than a formal methodology, but it does imply some vital things about the tools we use to build client/server applications.

RAD IS VISUAL

Whatever else it may be, today's RAD is definitely visual. It refers to the now ubiquitous point-and-click tools that let you paint a graphical interface with prebuilt controls and elements. Since the prototyping and development environments have essentially become one and the same, you can get continual feedback from end users, even developing while they watch. This helps kill off those applications that programmers love but end users hate. Most RAD tools also offer highly functional prebuilt controls, so once your in-

The latest wave of visual development tools promises slick client/server database applications in record time.

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terface is complete, making it work may take little or no coding.

When code is needed to customize functionality, RAD helps with high-level fourth-generation languages (4GLs) geared for the specific tasks at hand. In contrast to general-purpose third-generation languages (3GLs) such as C, C++, COBOL, FORTRAN, and Pascal, 4GLs can insulate you from the complexities of SQL database access, the client operating system, file I/O, memory management, and the client GUI's native API. Task-specific 4GLs make developing application logic far easier, helping you get prototypes and finished apps out the door much faster.

When it comes to finding the inevitable coding errors, a RAD tool usually offers full-featured debugging facilities. A convenient interpreted mode within an integrated development environment (IDE) for testing application components is also common.

Unfortunately, RAD tools lack the relative uniformity found in the world of 3GLs. No two look or act quite alike, and even basic development paradigms may differ radically. While some tools, especially those based on the object-oriented Smalltalk language, adhere faithfully to the object-oriented model, others are quasi-object-oriented, supporting only pieces of the paradigm. Some tools tie the application directly to interface objects, while others keep different types of program functionality in isolated and independent layers. Some let you create visual objects directly, while others make you first define data sources and then generate them for you. Weeding your way through these options to find a development system that fits the way you think is up to you.

After rather shaky beginnings, many SQL RAD tools are in their fourth or fifth releases, and their maturity shows. All produced acceptable results, and more than a couple behaved outstandingly.



• **SQLWindows Corporate Edition, Version 5.0**

RAD is a reality, but the tools aren't standing still. Now that the challenge of interface creation has been met, vendors are exploring other ways to make development faster and applications more robust.

The winner of our Editors' Choice award, SQLWindows, incorporates the best of the current trends in tools design. It offers efficient visual application construction in a highly productive integrated environment. Its object-oriented paradigm supports single and multiple inheritance, and its QuickObjects, a collection of highly useful prebuilt classes, helps you get complex applications off the ground fast. Its ability to generate C source code from your application also tackles the longstanding problem of poor 4GL performance. SQLWindows makes you scale a steep learning curve, but the view from the top is well worth the effort.

An honorable mention goes to PowerBuilder Enterprise 3.0a. This tool has deservedly become a classic of

the genre for its easy-to-use Painters, powerful DataWindows, and strong reporting and charting. PowerBuilder 4.0 is on the way and promises to bring important enhancements, including cross-platform portability and integrated compiler technology.

An honorable mention also goes to IBM's VisualAge Team for OS/2 1.0. This extremely impressive Smalltalk-based tool, which uses a drawing metaphor to connect and control Smalltalk Parts as you build your app, is destined to become a major force.

We were also very impressed with Team Enterprise Developer 1.0, whose innovative architecture brings order to the chaos of physical data sources, transaction-processing optimization, business logic, and front-end application code.

WHAT WE REVIEWED

This evaluation covers eight RAD tools for developing client/server applications for SQL databases. All the reviewed products are Microsoft Windows or OS/2 apps and provide visual programming tools, a 4GL, and connectivity to leading SQL database servers or to ODBC-compliant data sources. Initial research for this story turned up almost 60 development systems with some legitimate claim to RAD status. Even after we made a list just of PC-based tools with a specific client/server database focus, the list remained far too large for complete evalua-

tion (for a listing of RAD tools not fully reviewed, see the sidebar "RAD Tools: A Rapidly Developing Category").

Our final lineup covers those RAD tools we feel are of most interest to the largest number of developers. The list comprises Easel Corp.'s Object Studio, KnowledgeWare's ObjectView Enterprise 3.01, Digitalk's PARTS, Powersoft Corp.'s PowerBuilder Enterprise 3.0a, Gupta Corp.'s SQLWindows Corporate Edition 5.0, Symantec Corp.'s Team Enterprise Developer, Unify Corp.'s Unify Vision Enterprise 1.1, and IBM's VisualAge Team for OS/1 1.0.

We also looked at prerelease versions of two new RAD systems that hold significant promise. Borland International's project Delphi will be an Object Pascal-based visual programming tool positioned as a direct competitor to Microsoft Visual Basic. The second, Novell's Visual AppBuilder, is a code-free product that uses a visual drawing metaphor to let the developer

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connect prebuilt modules to create applications. We also evaluated a prerelease version of the next major release of the Oracle Cooperative Development Environment, which was not available in time for full review. Microsoft's Visual Basic Professional Edition has not had a revision since our last roundup and is not covered. Release 4.0 is expected in the first quarter of 1995.

PICKING A TOOL

A RAD tool for client/server development needs to be more than a pretty way to paint screens. To choose one, you have to weigh a number of features including database connectivity, reporting and graphing capabilities, the built-in language, group-development facilities, and cross-platform support. More fundamental distinctions, such as business modeling features or support for object orientation, may also be significant.

Database server connectivity varies greatly from tool to tool, and it pays to do your homework. For example, VisualAge supports a relatively limited number of servers—including DB2, DB2/2, and OS/2 Extended Services—while most of the other tools offer far broader connectivity. For example, Team Enterprise Developer supports DB2, DB2/2, Microsoft SQL Server, Oracle7, OS/2 Extended Services, SQL/400, Sybase, and XDB. To extend server support further, all except Visual-

Age also support Microsoft's Open Database Connectivity (ODBC) standard.

Reporting and charting tools let developers add meaningful and often complex views of data to applications. While some of the products we evaluate here provide only basic reporting capabilities or none

All these tools claim to be object-oriented, but some lack inheritance, encapsulation, polymorphism, and message passing.

at all, PowerBuilder and SQLWindows stand out for their advanced WYSIWYG features and support for complex report types such as crosstabs. If you're looking for charts and graphs, only about half the products we tested provide built-in business graphics.

All of the non-Smalltalk products offer 4GLs specifically tailored for data-access needs. Typically, these languages offer relatively simple syntaxes and short learning curves. Generally, writing code will be just a small part of the applications-development process. For example, PowerBuilder was able to complete our test application with less than 100 lines of code. Object Studio, PARTS, and VisualAge all use the mature Smalltalk 4GL, a standard language with considerable power and extensibility.

SQLWindows is unique in this group

because it lets you generate compiler-ready C source code from portions of your SQLWindows application. This gives the product an inherent performance advantage, since most of the other tested tools use compilers that produce tokenized pseudo-code (p-code) executables in lieu of true machine code. The Smalltalk tools use optimized Smalltalk interpreters that traditionally run on the slow side. Whether compiler- or interpreter-based, all the reviewed products except for Unify Vision

Enterprise let you distribute applications to end users royalty free.

Group-development capabilities, featured in most of the tools, not only protect you from other developers through check-in/check-out, but keep track of application and library version information. Some even let you roll back to a previous version if your latest revision has fouled things up hopelessly. Most tools also feature hooks into more third-party version-control systems such as Intersolv's PVCS.

MAKING SENSE OF OBJECTS

All of the tools we tested make some claim to be object-oriented. The trick is to distinguish productive object-oriented features from the sales pitch. Full object orientation demands support for the concepts of inheritance, encapsulation, polymorphism, and message passing. Three of the re-

HIGHLIGHTS

Rapid Application-Development Tools

VISUAL TOOLS—once a radical concept—are now the norm. All of the reviewed products offer “painters” or similar tools that let you build complex GUI screens and get them functioning in short order. Some include sophisticated GUI reporting and charting capabilities, as well. Environments typically provide their own controls with varying degrees of functionality. Some support the use of .VBX controls as well.

OBJECT-ORIENTED PROGRAMMING is on everyone's lips, but some implementations are more OOP than others.

While many of the development systems support some degree of classes and inheritance, a few offer fully object-oriented paradigms based on the powerful Smalltalk language. Whether strict or loose, the best object orientation is the kind that fosters a high level of code reuse.

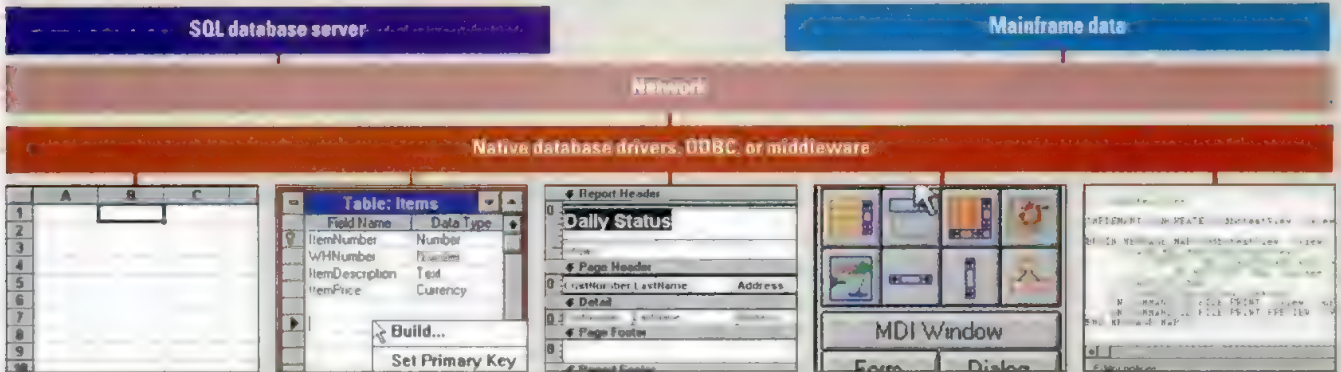
MODELING YOUR BUSINESS logic as a separate application layer is a new but important trend. While most current tools stick all the application logic straight into the interface, some let you keep your components apart. Encapsu-

lating business logic lets you inherit or change high-level conceptual objects—a customer object, for example—without having to reinvent your app.

TRUE COMPILERS are on the horizon. But with only one exception, all the reviewed systems still produce the sluggish pseudo-code executables typical of 4GL tools. Pseudo-code makes for easier cross-platform portability, but true machine code executables will run dramatically faster. Look for the introduction of more true compiler systems in the course of this year.

Picking Paths to Your Data

RAD tools offer only one of many paths to SQL or nonrelational data. But they cover the widest spectrum of tasks with an optimal balance of flexibility and efficiency.



Spreadsheets

- Aimed at power users.
- Moderately programmable for specific tasks.
- Limited or no query capability; limited reporting tools.
- Programming not required.
- Ad hoc decision support.
- Low deployment cost.
- Immediate deployment.
- Typically low support requirements.

PC databases

- Aimed at power users.
- Moderately programmable for specific tasks.
- Adequate to strong query capability and reporting tools.
- Programming often not required.
- Ad hoc decision support and reporting.
- Low deployment cost.
- Immediate deployment.
- Typically low support requirements.

End-user query and reporting tools

- Aimed at power users.
- Programmable for specific tasks.
- Strong query capability and reporting tools.
- Preprogramming by IS often required.
- General decision support and reporting.
- Low deployment and maintenance costs.
- Fast deployment with minimal or no development.
- Moderate support requirements.

Visual RAD tools

- Applications can be created for all end-user skill levels.
- Flexible database-oriented programming.
- Powerful form builders, query builders, and report-development tools.
- Requires strong database programmers; OOP skills increasingly demanded.
- Wide variety of transaction-processing, decision-support, and reporting applications.
- Reasonable deployment and maintenance costs.
- Prototype/development cycles typically reasonable.
- Medium support and maintenance requirements.

Traditional languages

- Applications can be created for all end-user skill levels.
- Flexibility limited only by available programmer skills.
- Third-party forms, query, and report-development tools may be required.
- Requires expert programmers; OOP skills increasingly demanded.
- General applications development.
- High deployment and maintenance costs.
- Prototype/development cycles typically long.
- Maintenance and support requirements typically high.

viewed tools—Object Studio, PARTS, and VisualAge—are based on object-oriented Smalltalk. These tools treat everything as an object, including variables, data elements, buttons, windows—even entire applications. Data and methods are fully encapsulated, and the application uses messages to obtain object services.

You don't necessarily need full object orientation. Basic inheritance can be a good compromise since it lets you reuse existing objects by inheriting their attributes and behavior. There is no need to write things from scratch if you, another developer, or the tools vendor have written what you need already. While the non-Smalltalk tools are not strictly object-oriented, most support single inheritance. SQLWindows stands out by supporting the powerful but potentially dangerous concept of C++-style multiple inheritance.

Cross-platform portability in a RAD tool offers the ability to move your application from platform to platform without modification. Some but not all of the products tested offer this kind of flexibility. The environment with the broadest cross-platform reach is Unify Vision Enterprise,

which supports Windows, Windows NT, and most flavors of Unix. On the other hand, two of the most popular tools, PowerBuilder and SQLWindows, are Windows-only environments. But both will add cross-platform support for OS/2, Windows NT, and Unix by next year. IBM has also announced plans to release a Windows version of VisualAge before year's end.

If you're a die-hard 3GL programmer with a big client/server backlog, it's high time to consider a move to RAD. If you're sold on RAD already, you should size up competing strategies for interface creation, database connectivity, and object orientation. Whichever camp you're in, the reviews that follow will bring you up to speed on today's most important tools.

Easel Corp.

● Object Studio

BY GABRIELLE GAGNON

We reviewed both the OS/2 and Microsoft Windows versions of Object Studio, Business Object Corporate Edition, one of several bundling schemes in Easel Corp.'s Object Studio products. Except

for multithreading support offered only by the OS/2 version and some connectivity differences, both packages are identical and share documentation.

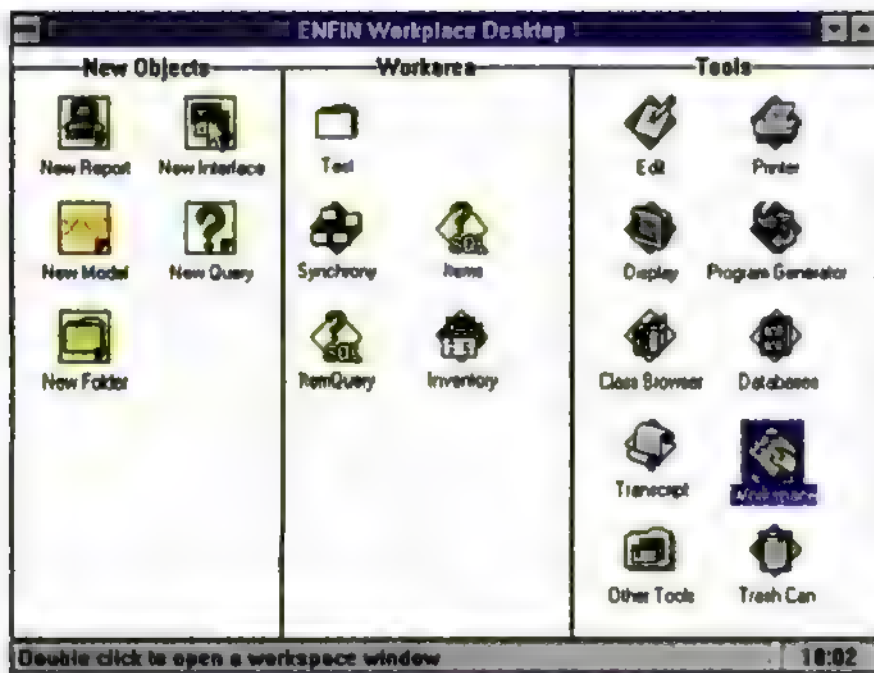
Currently, this edition of Object Studio comprises three main products: Enfin 4.0, a client-applications-development toolkit; Synchronicity 1.0, an object-oriented data-modeling tool; and Team-Builder 1.0, a set of tools for managing resources in a multideveloper environ-

SUITABILITY TO TASK

	Object Studio	
	Power	Ease of Use
Connectivity	GOOD/EXCELLENT*	EXCELLENT
Professional development	EXCELLENT	GOOD
DSS/reporting	GOOD	EXCELLENT
Prototyping/quick development	GOOD	GOOD

* The OS/2 version rated good, the Windows version rated excellent.

ment. There are also two add-on products for Enfin: the Peer Option, which supports LU6.2 Advanced Program-to-Program Communications (APPC), and the Distributed Presentation Option, which provides Emulator High-Level Language



Enfin's Workplace Desktop compartmentalizes storage into template objects, applications, and design tools.

Application Programming Interface (EHLAPI) support for developing GUI front ends to legacy minicomputer and mainframe applications. All five of these Object Studio products are bundled together in the Business Object Corporate Edition.

OS/2 LOOK AND FEEL

The mainstay of the Object Studio family—and its most mature product—is Enfin. First introduced as a client-applications-development tool for OS/2 and later ported to Windows, Enfin retains the look and feel of OS/2's Workplace Shell (WPS). Rather than change Enfin to suit the deployment environment, Easel opted to facilitate cross-platform development with a common paradigm, and OS/2's object-oriented WPS suited the object-oriented Enfin very well. A Unix Motif version of Enfin is expected to ship later this year, and it too will keep the WPS look and feel.

Enfin's Workplace environment is divided into three panels. On the left panel are template objects for new interfaces, reports, queries, models, and folders. On the right are objects representing Enfin tools for designing and running your application, managing databases, printing reports, generating code, and browsing objects. There is even a trash can icon for discarding objects that are no longer needed. The center panel is an area for storing your applications. As in OS/2, applications and their related objects are kept in folders, and you use both mouse buttons and drag-and-drop to manipulate objects directly.

Enfin is a point-and-click, parameter-driven programming environment that generates Smalltalk code. Smalltalk is a pure object-oriented language that is radically different from procedural programming languages such as BASIC or C. If you're unfamiliar with object-oriented programming (OOP) concepts, Smalltalk may also take some getting used to, but once learned, it's a highly extensible and productive language. Fortunately for novices, Enfin has so much functionality built into its interface that for simple

applications, a developer rarely needs to dip into the code.

Easel also provides extensive, easy-to-grasp Smalltalk documentation and on-line references. For sophisticated applications, developers have all of the source code for Enfin's classes at their disposal. Enfin applications compile to pseudo-code and require a runtime module.

Suitability to Task:

RAD Tools

The tools in this roundup take widely differing approaches to the challenges of RAD. To help guide you to the best solution, we rate each product's suitability for a broad set of important programming tasks. The Power score rates fundamental abilities while Ease of Use indicates how easily they can be exploited.

For our **connectivity** task, we weigh available support for back-end servers. A bundled selection of native and ODBC drivers is a plus. We also look at support for DDE, OLE, local PC database formats, and the ability to join heterogeneous data sources. Are gateways to enterprise data available? Is it easy to change data sources via point-and-click?

The **professional development** score indicates each product's overall depth and power. How strong is the supplied programming language, and is it extensible through 3GLs or DLLs? Are industrial-

Enfin ships with plenty of classes to support both transaction-processing and decision-support applications, and the Object Studio's Corporate Edition has additional support for minicomputer and mainframe communications. The product is especially well-endowed with business-analysis objects, and all of them can be incorporated into an application without writing a line of code. But if Enfin's built-in classes aren't enough, you can embed OLE 1.0 objects in your application or import custom objects in the form of DLLs.

Enfin supports access to both local and external databases. A bundled RAM-based database can be used for prototyping and testing, and the Windows version of Enfin supports local dBASE databases.

The Windows version of Enfin enjoys much broader external database support than the OS/2 version. Both the OS/2 and Windows versions have direct API support for DB2/2, Oracle7, SQLBase, and SQL Server. Both also offer access to DB2, SQL/400, and SQL/DS via IBM's DDCS/2 gateway, and to DB2, SQL Server and Or-

strength debugging facilities provided? Architectures that promote high code reuse receive a high rating. We also look for support for team development, version control, cross-platform application distribution, and the ability to produce true executables.

Decision Support System (DSS)/reporting

applications demand a strong graphical report writer and good charting capabilities. Are there facilities for easily building complex queries? Does the product have high-level financial or other analysis functions?

To judge suitability for **prototyping/quick development**, we look at the efficiency of visual tools for creating menus, dialog boxes, simple and complex forms, queries, scripts, reports, and charts. How easy is it to associate these objects with back-end data sources and application logic? How much code

is required to build functional apps, and how easy is the product's language to use? How good are help and documentation facilities? The ability to exploit prebuilt components earns extra points.

SUITABILITY TO TASK

	Company Name Here	
	Power	Ease of Use
Connectivity	EXCELLENT	POOR
Professional development	GOOD	FAIR
DSS/reporting	FAIR	GOOD
Prototyping/quick development	POOR	EXCELLENT

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How We Tested

In general, all the reviewed products deliver on the promise of rapid application development. PowerBuilder 4.0 and SQLWindows Corporate Edition 5.0 in particular flew through our test application. The biggest differences among products appeared on our reporting and graphing tests, where some packages lacked the required capabilities outright.

To evaluate client/server rapid application-development tools for this roundup, we required each package to build an order-entry application to our specifications. We based our test application on five database tables, which we called Customers, Sales, Detail (which gives a further level of sales information), StockItems, and SalesTax, along with each table's appropriate indexes. The specification required each product to build menus, data-entry and query screens, columnar reports (with both screen and printer output), and graphs.

We asked all vendors to send technical representatives to PC Labs to work with our reviewers in constructing this application. Two and a half days were allotted for testing, and all vendors were able to finish the assigned tasks in that time.

We asked the vendors to create the tables for the test database using their products' tools. If the appropriate administration tools were not included, we provided a SQL script. For Unify Vision Enterprise 1.1 and VisualAge Team for OS/2 1.0, which do not have built-in administration tools, the vendors chose to use server-based tools. Gupta used its own Quest product bundled with SQLWindows, while Powersoft used PowerBuilder's built-in database-administration tools. The remaining vendors accomplished these setup tasks using our SQL script. After the tables had been built, we imported our sample data.

BUILDING THE APP

Enterprise Developer and Object Studio stressed construction of a logical business model to serve as the foundation of the application. Both vendors of these products—particularly Easel—spent a significant amount of development time designing the business model before starting to build the interface portion of the application.

For other vendors, the first task was to build a menu to connect all the application's parts.

Digitalk's PARTS, Unify Vision, and VisualAge used object-oriented menu classes or objects that were subclassed. The other products employed more conventional menu builders. All of the Windows products, with the exception of Unify Vision, built the rest of the application using a standard Multiple Document Interface (MDI) approach, while the OS/2 products went with more traditional dialog box screens.

One of the more demanding portions of our test is the order-entry form, which requires joins among four tables. It also performs lookups and calculations in a master/detail configuration and displays a bitmap. We required each vendor to use a Microsoft Visual Basic custom control in this form if its product supported the .VBX control format.

Enterprise Developer and SQLWindows excelled at creating the test order-entry form; both were able to build the master/detail form almost automatically. PowerBuilder required moderate coding as did the Smalltalk-based products Object Studio, PARTS, and VisualAge. But PARTS was able to display only a read-only grid for the Detail portion of the form and required a workaround to populate it. Of the Windows products, only PowerBuilder and SQLWindows could use the .VBX control directly, though a savvy programmer could design a wrapper for use with Object Studio or VisualAge. Digitalk's PARTS is a 32-bit Windows application running under Win32, so it cannot support a 16-bit .VBX control.

Our script called for two different uses of bitmaps: as a logo on the form and as a binary large object (BLOB) stored in the database. All products are able to support bitmapped images stored on the server, and all but VisualAge are able to load bitmaps from files for display as logos. VisualAge requires that the bitmap be incorporated into a DLL first.

Our script put the products through several reporting tasks, including building a simple

tabular report, a multipass report, and a cross-tab report. VisualAge does not have any built-in reporting or graphing capabilities, and Unify Vision has only rudimentary text-only reporting. We allowed Unify Corp. to use Borland International's ReportSmith 2.0, an optional add-on for Unify Vision, in order to complete the test.

PowerBuilder and SQLWindows easily handled the cross-tab report with their built-in tools, while Symantec was forced to perform extensive coding. None of the Smalltalk-based products attempted the cross-tab report.

Additional test reports included an invoice report, a weekly detail report, and a yearly sales report. The invoice report is similar to the order-entry form and requires joins among the Customer, Sales, Detail, and StockItems tables, as well as a lookup in the SalesTax table. The weekly report lists each customer's purchases for a given time period and includes subtotals and totals. This report joins the Customer, Detail, and StockItems tables and provides a dialog box for entering the dates to report. The yearly sales report calculates the total annual sales for a specified year, displaying the total sales to each customer and a grand total for sales for the year. Both the weekly and yearly sales reports required multiple passes at the data.

As the last task, each product was required to create graphs of sales by month and average sales per day in both pie- and bar-chart formats. PowerBuilder and SQLWindows accomplished the task easily with their built-in charting modules, as did Object Studio with its chart and business-analysis objects. Enterprise Developer was able to produce graphs, although we first had to output the required data to a virtual column in the database. PARTS, Unify Vision, and VisualAge do not support charting.

Each vendor had the option of attaching to Microsoft SQL Server 4.21 or Oracle7, Version 7.0.16, as a back-end data source. Although all products successfully attached to both, most vendors chose to develop their applications using Microsoft SQL Server. The test client was a Compaq Deskpro 486/33M with 16MB of RAM and a 340MB hard disk. The file server was a Compaq Systempro 486/33 with 32MB of RAM and two 1GB Seagate Barracuda hard disks. We ran Windows products under Microsoft Windows 3.1 with DOS 6.2 and OS/2 products under OS/2 2.1. We used two network operating systems according to the back end used: NetWare 3.12 or Microsoft NT Advanced Server 3.1.

—Analysis written by Jay Munro

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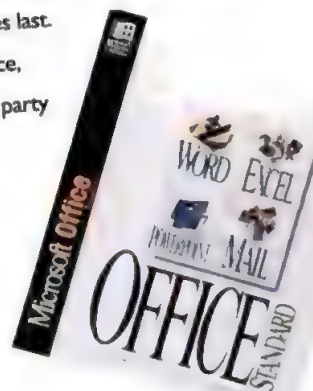
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acle via MicroDecisionware's MDI gateway. But only the Windows version has access to AllBase/SQL, Informix, Ingres, RDB, and Teradata—to name just a few—via EDA/SQL middleware. In addition to an extensive array of relational DBMSs, EDA/SQL provides access to nonrelational data sources such as IMS/DB, Datacom/DB, IDMS databases, and ISAM and VSAM files. EDA/SQL access to nonrelational data plus add-on support for EHLLAPI and APPC make Enfin an excellent tool for building front ends to legacy systems.

Enfin's database tools include a Database Notebook, a Report Editor, and a SQL Editor. The Database Notebook is a simple, end-user tool that uses a tabbed notebook metaphor. You can use it to add or drop tables, define schemas, update data, generate SQL queries, and print default reports with speed. The Report Editor is a columnar report generator that offers full text- and graphics-formatting capabilities, but its numeric formatting capabilities are limited. We were unable to specify a fixed number of decimal places to use when displaying floating-point numbers, for example.

For SQL queries, you can manually enter a query in a SQL Window or have Enfin construct queries for you in its menu-

driven SQL Editor. Enfin also provides front-end scrolling cursor support. This feature lets you make updates to data locally before committing them to the database.

SYNCHRONICITY

Object Studio's Synchronicity component provides object-oriented analysis and design facilities to be used in tandem with Enfin. Synchronicity supports the object-oriented modeling notations of Coad/Yourdon, extended ERD, and Rumbaugh and some responsibility-driven design elements of Wirfs-Brock, but at this point, it does not provide comprehensive support for any of these methodologies.

Synchronicity is targeted at designing an object-oriented business model representing aspects of the business that are common across applications. When the business model is ready, Synchronicity uses it to generate Smalltalk classes for use in Enfin applications. Synchronicity is also supposed to update the model whenever changes are made to an application, thereby keeping the model and the applications synchronized. The idea behind Synchronicity is to separate the business model from the user interface so that developers can encapsulate and reuse high-level components—a Customer object, for example—in different applications. Most front end development tools today, including Enfin, embed the application's business logic in the user interface. This binds it to a physical implementation, limits its utility, and complicates maintenance.

Easel is currently reengineering Enfin to work with this new layer of business objects, but at this writing, most of Enfin's point-and-click functionality is unusable when working with the business object layer. Our testing showed that a considerable amount of Smalltalk coding was necessary in order to use the business model in even simple applications, defeating the purpose of a rapid application-development tool. Easel plans to add a new product to the Object Studio family that will visually link business objects to data sources, eventually leveraging Enfin's RAD capabilities. Right now, Enfin is still

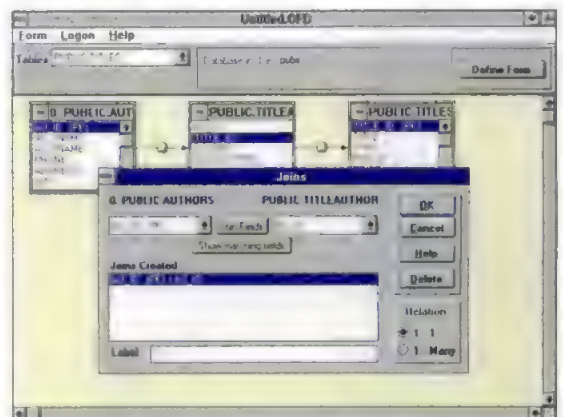
very much a tool designed to embed its logic within its interface, and trying to use it in another way is confusing. Unless you're prepared to spend a lot of development time writing code, we recommend using Enfin as it was originally intended until its identity crisis is over.

KnowledgeWare Inc.

● ObjectView Enterprise

BY STEPHEN W. PLAIN

A good front-end development tool should be more than the sum of its parts. A case in point is ObjectView Enterprise, Version 3.01, a Microsoft Windows-



ObjectView's Logical Data Modeler creates a form definition file from which you generate a visible form.

based development system that has all the functionality and connectivity required for building client/server applications but lacks the cohesive interface to make the package as productive as it could be.

Partly because of KnowledgeWare's recent acquisition of ClearAccess Corp.'s ClearAccess query tools, ObjectView Enterprise is in the middle of a transition that should ultimately improve its value. But its currently somewhat disjointed interface makes applications development more difficult than it should be. ObjectView Enterprise comprises the base ObjectView development environment, workgroup features, and a reporting module. A single-user copy of Gupta's SQL-Base SQL engine is also included.

COLLECTION OF PROGRAMS

ObjectView Enterprise is not a single application but rather a set of programs, each designed to perform a specific task.

The central element is a program

► FACT FILE

Object Studio, Business Object Corporate Edition



List price: OS/2 version, \$16,500; Windows version, \$12,900 (both prices include Enfin 4.0, Synchronicity 1.0 and TeamBuilder 1.0). **Requires:** 386-based PC or better, 16MB RAM, 15MB hard disk space. OS/2 version: OS/2 2.0 or later; Windows version:

Microsoft Windows 3.1 or later. **In short:** Each of these two virtually identical offerings consists of Enfin, an object-oriented, Smalltalk-based visual development environment; Synchronicity, an object-oriented modeling tool; and additional team development and connectivity components. Enfin is a mature product well suited to building DSS applications and front ends for legacy systems. Synchronicity offers powerful object-oriented business modeling that allows a clean separation of business and applications logic. The two tools are not yet well integrated, and using them together can keep Enfin from shining as a RAD tool.

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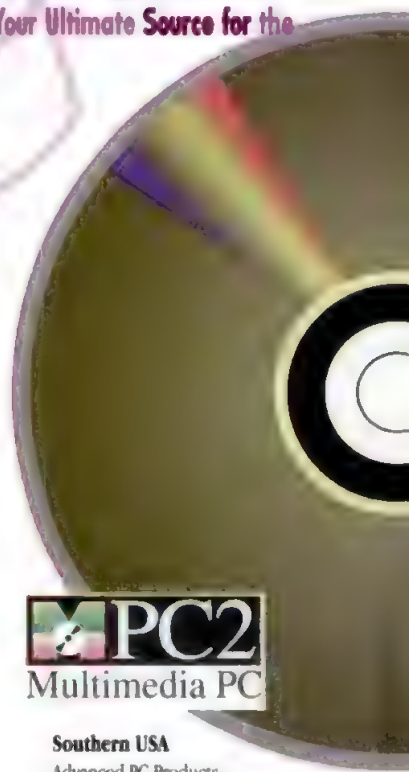
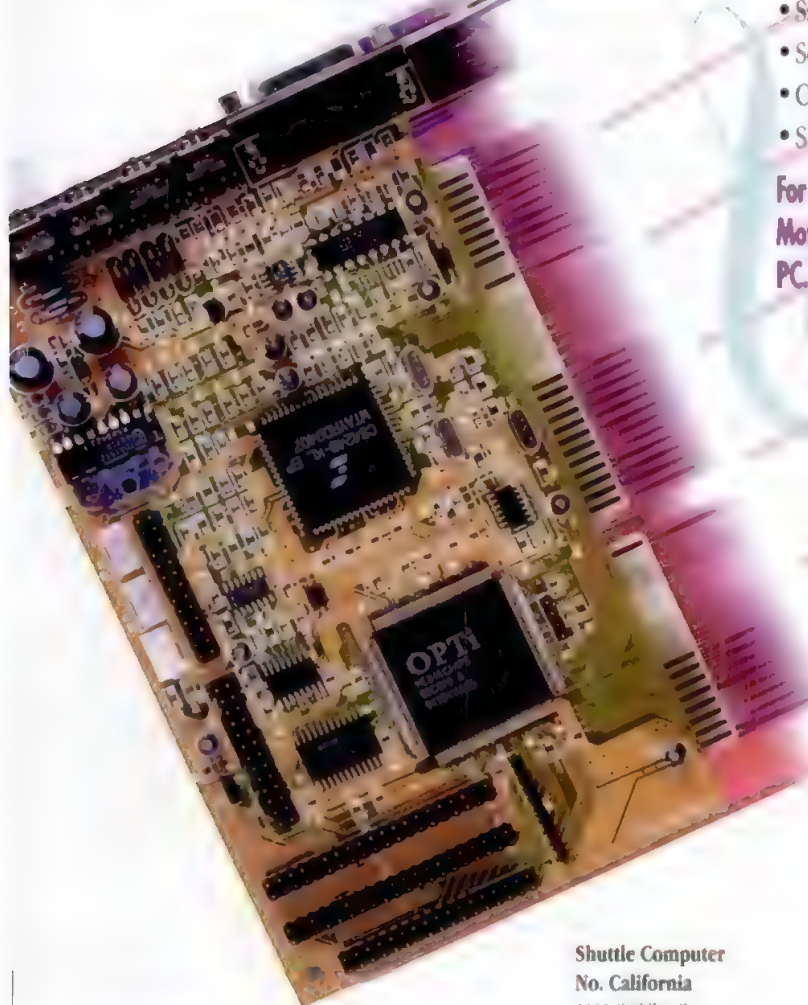
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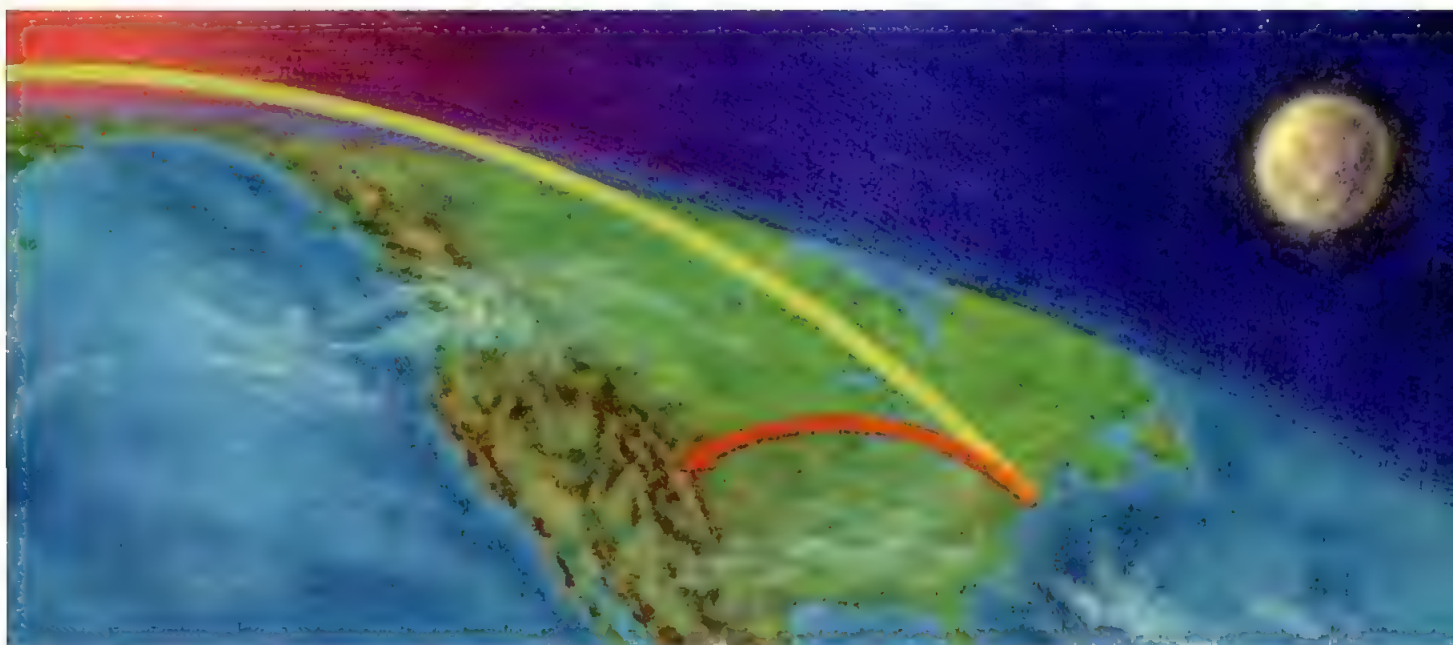
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called the Editor that lets you paint windows, construct applications, and launch other utility programs as necessary. Within the Editor, you lay out your windows using visual controls from the Toolbox, a floating palette that provides controls such as spreadsheets, data-entry fields, combo boxes, table objects, graphic images, and shapes. To utilize the tools available in ObjectView Enterprise fully, you must start in another module, called the Logical Data Modeler.

The Logical Data Modeler lets you visually establish the view that your window will use. By selecting the tables you wish to use from a combo box on the toolbar and establishing relationships among them by dragging the mouse among fields, you define where the data should come from and how the relationships among tables should be maintained when working with your form. The Logical Data Modeler creates *panels*, which are similar to PowerBuilder's DataWindows, which provide a result set and a default field layout for each table used in the window. Though only a single table can be defined per panel, you can use multiple panels within a window. As with most of the modules in ObjectView Enterprise, you can jump to the Logical Data Modeler from the Editor or launch it separately from the ObjectVision program group.

When you exit the Logical Data Modeler, you have defined an .OFD file containing the form definition, but you still have no form to look at. You must run the Form Generation menu option from the Editor to turn this definition into an actual window you can work with. The result is a window with visual panels as defined in the .OFD, and an associated script file named with an .OBS extension. Each window in an ObjectView Enterprise application has an associated script file written in the product's native language, ViewScript. After you've generated a window, you can work with it directly in the Editor. Experienced users can create windows directly in the Editor and write the script without using the Logical Data Modeler at all.

VIEWSRIPT LANGUAGE

At the heart of ObjectView Enterprise is the ViewScript language, a BASIC derivative that provides over 700 commands and functions. While the language is hefty in size, it is easily learned; each command is prefixed with a meaningful syllable. For example, functions that get values start with Get, functions and commands that reference forms start with Form, and those commands that manipulate data in

panels begin with Panel. The language is well documented in both its manual and in the product itself.

The compiler module, which can be accessed from the Editor with the

F5 key, gives you an editor/debugger for working with ViewScript code. The Syntax menu in the Compiler gives you a helping hand in adding to and understanding your code. Selections from this menu let you paste in syntactically correct commands, functions, subprocedure declarations, and even complete control structures such as If/Else, Do/While, and For/Next loops. As you scroll down the list of commands, there is also a help box that explains the purpose of each, an added touch that saves time.

The debugger component of the Compiler is a fairly full-featured sleuth that provides the ability to trace through your

code one line at a time, establish multiple breakpoints, monitor watch variables in a separate window, and modify a particular variable while code execution is paused. You can also selectively interrogate variables that are not on the watch list.

To use the debugger, you must compile your scripts in Debug mode, which generates the necessary definition file. Since each script is associated with a particular form, you must manually load the compiled scripts for each window into the debugger in order to debug a multi-windowed application completely. Finished applications can be distributed using the royalty-free runtime engine.

ObjectView Enterprise offers wide connectivity out of the box with native or ODBC support for dozens of database formats, including EDA/SQL, Gupta SQLBase, Microsoft SQL Server, Oracle7, SQL/400, Sybase SQL Server, Teradata, and XDB. Local database formats supported include Access, ASCII, dBASE, FoxPro, Microsoft Excel, and Paradox files. Standard connection commands are part of the ViewScript language and are generated automatically by the Logical Data Modeler for the database to which you're connected. By managing multiple connections through code, you can work with multiple data sources within the same application.

This version of ObjectView Enterprise drops the previously included Personal SQL reporting component and substitutes the ClearAccess and ClearReports programs for reporting. ClearAccess provides a point-and-click mechanism for building the queries that drive your reports, accessing your middleware to find the available data sources. Once you've defined your query, you can save the connection and query statements to a script that produces a data set for ClearReports to work on. ClearReports is a visual, banded report writer that offers a great deal of flexibility. Unfortunately, there is no direct connection to ClearAccess from ObjectView; reports must be launched from code via DDE commands. Future versions of the product will more tightly integrate this powerful reporting component and will add other needed features, such as support for Microsoft Visual Basic controls.

A couple of additional modules add

SUITABILITY TO TASK

ObjectView Enterprise

	Power	Ease of Use
Connectivity	EXCELLENT	GOOD
Professional development	GOOD	EXCELLENT
DSS/reporting	GOOD	GOOD
Prototyping/quick development	GOOD	GOOD

► FACT FILE

ObjectView Enterprise, Version 3.01



List price: \$3,200. **Requires:** 386-based PC or better, 4MB RAM, 15MB hard disk space, Microsoft Windows 3.1 or later.

In short: ObjectView has the functionality and connectivity for client/server development, but its interface lacks cohesive

integration. Its BASIC-like ViewScript language is hefty but easy to learn. ObjectView has a full-featured debugger, Gupta's SQLBase engine, and querying and reporting tools. While it lacks some sophisticated features, it can be effective for those who prefer form-by-form development to nuts-and-bolts OOP.

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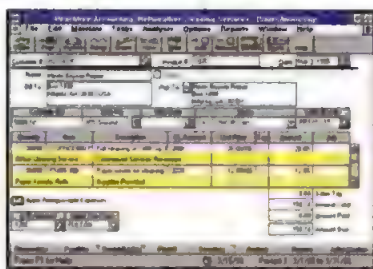
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CIRCLE 393 ON READER SERVICE CARD

▪ Due This Winter: Oracle CDE2

By Mark S. Childers

Oracle has not shipped a major revision of its Cooperative Development Environment (Oracle CDE) since our last roundup of client/server development tools, but an important new release is expected by the first quarter of next year. Our look at a beta version of this new product, tentatively named Oracle CDE2, shows a strengthened feature set, improved connectivity, and better ease of use.

Like its predecessor, Oracle CDE2 will be a collection of bundled tools, the most important of which are Oracle Forms, Oracle Reports, Oracle Graphics, Oracle Book, SQL*Plus, and SQL*Net. The first three, which form the core of the suite, sport Oracle's slick new Object Navigator. This is a graphical outline viewer that provides a hierarchical representation of your application's modules, reports, or graphs. Once you're connected to the database, the Object Navigator also provides graphical facilities for viewing and editing tables, stored procedures, and views. Its drag-and-drop support lets you move objects from one application module to another.

The new Oracle CDE2 will be one of the first client/server tools to offer full OLE 2.0 support. This will give you powerful integration capabilities—letting you embed an Oracle Graph seamlessly into an Oracle Form or a server-based BLOB into a third-party application, for example.

Unfortunately, the separate parts of CDE2 are not yet seamlessly integrated into a unified development environment. And because each application module is stored as an independent file, you have to open each part separately in order to view your application as a whole.

CONSTRUCTION CENTRAL

Application construction will center around Oracle Forms. Here you will

create your program modules, of which there are three types: Forms, Menus, and Libraries. Forms consist of basic windows with controls. All window controls are grouped into Blocks that are associated with an underlying database table. Blocks are data-aware objects with inherent functionality such as Update, Delete, Insert, and Commit capabilities. Multiple blocks let you view multiple database tables on a single screen. These blocks are placed on a canvas where you can manipulate their properties and positions. The new Property Palette offers a convenient place to edit all the properties of the selected item.

Users familiar with Oracle databases will have no problem coding in the CDE2 environment.

Oracle has settled on its PL/SQL as the scripting language, so whether you are writing a stored procedure or a local procedure, you will be coding in the same language. The PL/SQL interface has been enhanced with a source-level debugger, an editing environment for stored procedures, and incremental compilation. Support for VB controls, external DLL function calls, and links to Intersolv's PVCS version-control product have also been added.

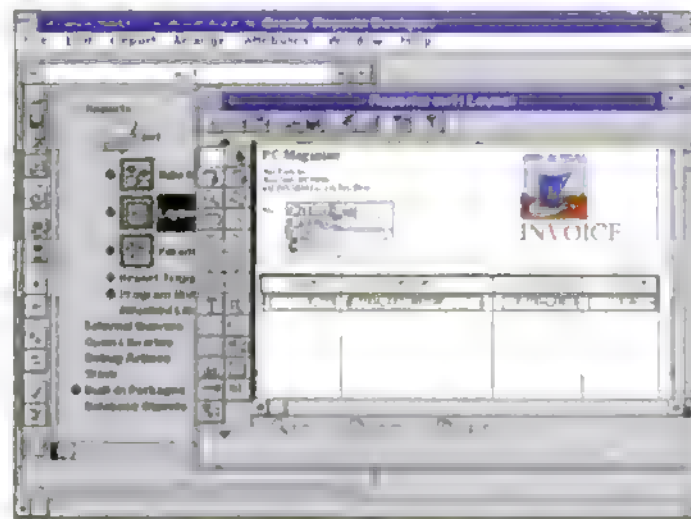
Oracle Reports is an industrial-strength report writer that will let you handle complex reports with ease. Oracle has done away with the banded approach, something that may be slightly confusing at first. Reports consist of Data Frames, which are defined as *repeating* for detail information or *nonrepeating* for general infor-

mation, such as a customer's name and address on an invoice. Inside these frames, you will place fields that are linked to queries developed in the graphical Data Model tool.

Oracle Graphics has also received a face-lift. In addition to the Object Navigator, it now features Chart Genies—dialog boxes that step you through the process of building a graph. The dialogs also sport a new tabbed-folder look. Oracle Graphics provides full OLE 2.0 server support so graphs can be embedded into any OLE 2.0 container. Automatic drill-down capability has also been added.

Oracle Book is a utility used to create on-line help and documentation. SQL*Plus, also included in CDE2, is an enhanced version of SQL*DBA, Oracle's command-line database utility.

CDE2 will offer support for



An improved report-writing capability is one of the many features that will be offered by Oracle's upcoming CDE2.

a number of platforms, including Macintosh System 7, Windows 3.1, and most Motif-compatible Unixes. All applications developed under one platform will be source level-portable to other supported platforms. Oracle still charges runtime licensing fees for deployment but these have been somewhat reduced. In the current version of Oracle CDE, you can connect components to Oracle7 via the SQL*Net interface or to ODBC data sources.

Oracle CDE2 shows considerable promise, despite somewhat less-than-perfect overall integration. In particular, users of Oracle7 database servers will want to evaluate this product when it ships. □



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value to the ObjectView Enterprise package. An Object Library is provided that can be used to hold standardized objects such as forms, UI elements, and scripts for developers in a workgroup to draw from. Version control is implemented in the File Library program, which provides a user-friendly interface for check-in/check-out and project-build operations. Within both the Object Library and the File Library, you can define user- and group-level security. The Object Library lets you organize objects by folders, while the File Library maintains specific releases of applications. By maintaining a chronology of releases, the File Library can easily produce earlier builds of an application to rectify accidental steps backward.

While the current version of ObjectView Enterprise suffers from a lack of tight integration, it does provide some powerful tools for client/server development in a workgroup environment. Once you are accustomed to the steps in generating panel-driven forms and you've gotten used to the product's quirks, you'll be able to turn out applications in rapid order.

Digitalk Inc.

PARTS

BY GABRIELLE GAGNON

Digitalk pioneered the first commercial release of Smalltalk—a pure object-oriented language—in its Smalltalk/V product and later trailblazed construction-from-parts technology with its PARTS Workbench. In PARTS (Parts Assembly and Reuse Tool Set) the company bundles these two innovative products together to create an integrated, cross-platform development toolkit for building client/server applications.

PARTS also includes Team/V, a team configuration-management package that includes Intersolv's PVCS version control and the PARTS Report Writer. When used with the additional PARTS Wrapper for Relational Databases, PARTS comprises a client/server development environment that's hard to

beat for sheer power and productivity. And since PARTS's *modus operandi* is to build reusable parts, the more you work with the product, the better it gets.

EASILY PORTABLE

Cross-platform portability is one of PARTS's strengths. The product is available for OS/2 as well as for Windows 3.1 and Windows NT (both of which are supported under the Win32 version reviewed here). Windows NT users should note that PARTS for Win32 is currently only available on the Intel platform, however. PARTS applications have both source and binary portability as long as no system-specific classes are used—for example, classes that handle multithreading. Digitalk also supplies cross-platform widgets if they are not available in the host environment.

The PARTS Workbench development environment is based on a construction-from-parts paradigm. With this technology, developers assemble applications by visually linking prefabricated components. As you build an application, you can combine existing parts to form new modules. You can also modify the behavior of existing parts through scripts. This approach offers direct manipulation of components and is a highly intuitive way to write applications using very little coding.

To build an application in PARTS Workbench, you select application components called *parts* from the PARTS Catalog and drag them to a workspace window. Then you link the parts by drawing connections with the mouse. There are over 60 standard parts that ship with PARTS Workbench, and as you create new parts,

you may add them to the catalog. You can save parts as .PAR files which can be used as-is on any platform within the PARTS environment, or you can compile them into DLLs for use in PARTS or other environments. Although PARTS applica-

tions may be compiled to .EXE files, they still require PARTS runtime modules.

The PARTS Catalog is a notebook similar to the OS/2 Notebook control that groups types of components under tabs. Each tab may contain several pages of parts, so subtabs are provided for each page. Somewhat obscure icons are used for tab headings instead of text.



PARTS forms apps by linking prefabricated components, combining existing components, or forming new ones.

Three types of links are available in PARTS: *event links*, *argument links*, and *result links*. Event links connect events—the user clicking a push button, for example—to messages that are sent to parts. (In object-oriented programming, sending a message to an object, such as a part, is like issuing a subroutine call in traditional programming.) Argument links supply any necessary values to a message, and result links allow several messages to be spawned from a single event or argument. Each of these links is depicted by a color-coded arrow indicating the direction of the message and whether or not all the parameters have been supplied. The full display shows all the events and messages associated with each link.

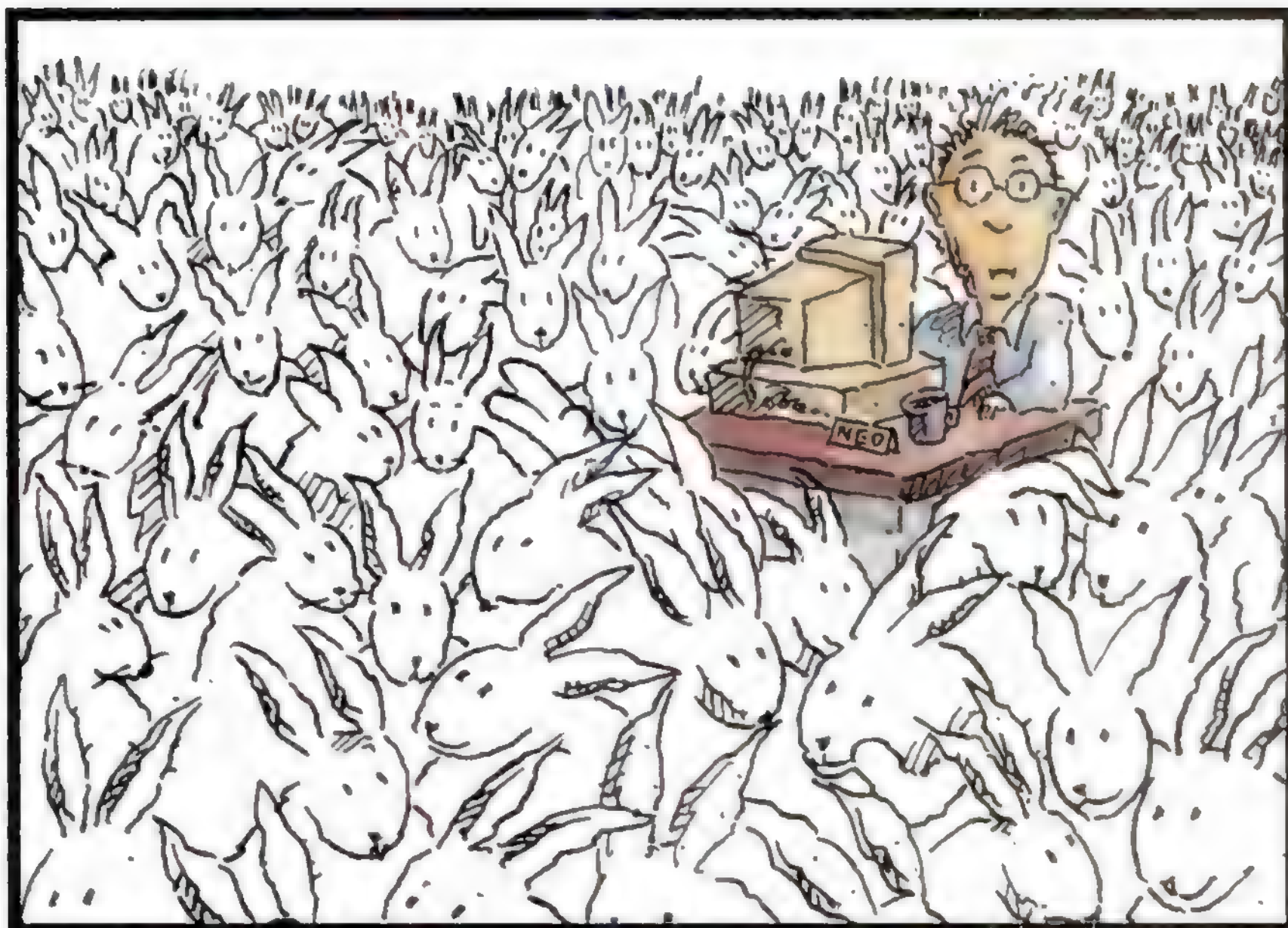
Even though there are various options for hiding links and their associated details, applications can soon become unreadable. The paradigm encourages you to partition your application and encapsulate as much as possible. Once encapsulated, the internal links of a part become invisible.

POWER OF SMALLTALK

When prefab parts or messages are not enough to meet your needs, PARTS provides all the power and extensibility of

SUITABILITY TO TASK

	PARTS	
	Power	Ease of Use
Connectivity	GOOD	EXCELLENT
Professional development	EXCELLENT	GOOD
DSS/reporting	FAIR	GOOD
Prototyping/quick development	GOOD	GOOD



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• Novell's Visual AppBuilder

By Stephen W. Plain

If Novell has its way, we'll soon be developing our client/server applications at a much higher level than ever before. With its announced AppWare Bus technology, Novell envisions programming with visual design tools that link fully functional application components together to form macro-applications. These will be customized to users' needs, yet take far less time to build than traditional programs.

The prebuilt modules in this scenario are called ALMs (AppWare Loadable Modules). The flagship development product that lets you combine them is Novell's still-unreleased Visual AppBuilder. This tool originated in the Macintosh-based Developer Pro from Serius Corp., which Novell acquired. Visual AppBuilder is scheduled to debut on both Macintosh and Microsoft Windows platforms and should be available this year.

ANATOMY OF AN ALM

ALMs are application components built for specific tasks. From a structural point of view, they are essentially DLLs with an associated configuration file. An ALM can be a button, a connection to a SQL database, or even a complete invoicing module. An ALM usually comprises a single object as well as the set of functions it can perform and the events that are used to communicate with other ALMs. Many existing DLLs can also be easily wrapped into an ALM. ALMs are interconnected across a network by the AppWare Bus, a software layer analogous to a PC's I/O bus.

Visual AppBuilder is a completely visual development tool that lets you snap together prebuilt ALMs using a drag-and-drop, point-and-click approach. No traditional coding is involved. This not only has the potential to reduce development time drastically, it also greatly reduces the risk of bugs.

Each object and function is presented to the developer as an icon in a scrollable palette that can be dragged into the main application window. By dragging arrows among object and function icons, you establish chains of operations that make up your application's behavior. Each arrow assigns an associated event to the object or function from which it comes. For example, an arrow from a button might be assigned to an event such as Pressed;

an arrow coming from a New Record function of a database object might be assigned to that function's After Adding event.

This can take some getting used to, especially if you're used to traditional programming. But

once you've familiarized yourself with the available objects and functions, you become incredibly productive. You may not even need to be a programmer—although you'll certainly need to be as organized as one. Once you start plopping icons and dragging arrows, your application can soon become cluttered and incomprehensible.

Fortunately, Visual AppBuilder provides a way to organize applications into discrete components, called Subjects. An application can be made up of several subjects, each of which

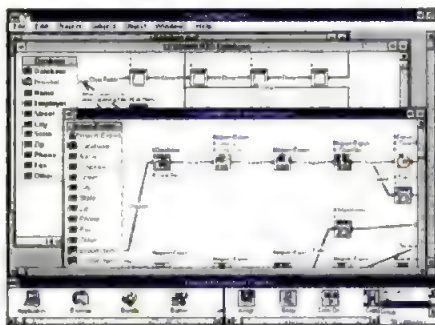
appears as its own container window that you populate with object chains. Any object or function in one Subject can be made visible to another by simply defining it as *shared*.

There is another reason that the proper use of Subjects is critical, and it opens the door to myriad new possibilities. Although the first release of Visual AppBuilder will only let you create one executable per application, you will eventually be able to compile each subject as its own executable. Since all of the inter-ALM communication at runtime is accomplished by the AppWare Bus software layer, you will be able to implement distributed processing in your applications with minimal effort. It remains to be seen whether this actually works well in practice. If it does, it may blur forever the distinction between client/server and LAN-based applications.

BIG BUNDLE

When Visual AppBuilder ships, it will come with over 70 bundled ALMs that provide a wide array of functionality. These will include the Essential ALMs—a set that provides the foundation for application development—as well as several other bundled ALMs from Novell and third parties. All of the standard looping, variable manipulation, menuing, mathematical calculations, and user-interface controls are encapsulated in the Essential ALMs in a well-organized manner. In addition, a Database object is provided that gives you a flexible tool for creating databases that can contain not only traditional field types, but any type of multimedia object or document you want to organize.

At this writing, Novell has not announced a firm ship schedule. But when Visual AppBuilder becomes available—possibly by the time you read this—it has the potential to revolutionize the concept of RAD. □



Visual AppBuilder uses a drawing metaphor to assemble prebuilt AppWare Loadable Modules.

Smalltalk/V, a complete object-oriented programming language. PARTS makes it easy for you to create new methods from within PARTS Workbench, or you can go directly to the Smalltalk tools to develop new classes for use in PARTS applications. The Smalltalk environment has numerous resources such as workspaces and

FACT FILE

PARTS



List price: PARTS Workbench 2.0, Smalltalk/V 2.02, Team/V 1.2.1, and PARTS Wrapper for Relational Databases, \$5,995
Requires: 386-based PC or better, 12MB RAM, 20MB hard disk space, Microsoft Windows 3.0 or later **In short:** This

integrated, cross-platform development toolkit lets you link prefabricated object components visually. It also provides the extensibility and power of the Smalltalk object-oriented language. SQL database support is adequate, but the reporting module needs a little smoothing out. But if you're looking for the power of true OOP, PARTS is an elegant tool.

Digitalk Inc., 5 Hutton Centre Dr., Santa Ana, CA 92707; 800-546-6400, fax, 714-513-3100

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the Transcript Window to facilitate prototyping and testing. For error recovery, the system maintains a log of all the changes made to its image in a separate file. You can restore previous versions of a class or method by filling in code from the log, or you can revert to a previously saved image file. If you are unfamiliar with Smalltalk, the Digitalk documentation is excellent, and several sample applications are included to help you get started.

PARTS supplies interoperability with other applications via its DDE components and add-on wrappers, which are sold separately. A wrapper encapsulates an external module and enables it to function in an object-oriented environment. The DDE components provide both DDE client and server functionality. OLE support is not yet available but will be soon. A wrapper for CICS transactions and a COBOL wrapper are slated for the Win32 platform by the next release.

For database connectivity, PARTS Wrapper for Relational Databases provides a healthy blend of PC and client/server support. The database wrapper relies exclusively on Intersolv's Q+E ODBC drivers to make its connections. With it,

you can access Sybase and Microsoft SQL Server and Oracle7 databases as well as ASCII, dBASE, and Microsoft Excel files. Without the wrapper, PARTS provides access to Btrieve files alone.

Multiple connections can be made for each type of database, and you can exchange data among databases. In addition to relational and flat-file database parts, the Relational database wrapper includes a SQL Library part and a Transaction part. The SQL Library part provides full ANSI SQL support as well as scrollable cursors. When used in conjunction with the Transaction part, the SQL Library part can define database transactions using Commit and Rollback commands. Remote procedures are also supported. While the relational database parts provide considerable functionality, we found them cumbersome to use during our testing. Common database operations, such as retrieving records or validating entries, all require customized methods.

The PARTS Workbench Report Writer is a new addition to PARTS, and it still has some rough edges. Its formatting capabilities are adequate for producing simple columnar or form reports. Like crosstabs, two-pass reports are also beyond its capabilities, and PARTS does not supply business charts or graphs. Many of the report writer's formatting restrictions are imposed by the Report Frame part. All reports must be placed within a container part called a Report Frame, and Report Frames can only include Report Structure parts or Report Content parts. You cannot, for example, embed a graphic or a DDE part in a Report Frame. But within its limitations, Report Writer's design is consistent with the rest of PARTS and is easy to learn and use.

PARTS represents a new generation of object-oriented tools that offer power without crippling difficulties. A highly extensible, cross-platform development tool that produces high-quality applications with a minimum of effort, PARTS is also an elegant vehicle for recycling code. If you're intrigued by the possibilities of object-oriented programming but have been put off by its complexity, this is a good place to dig in.

Powersoft Corp.

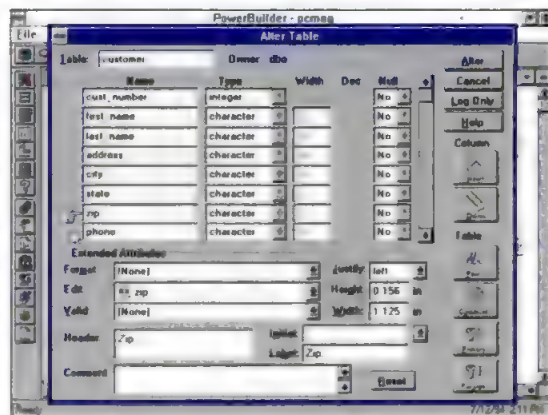
PowerBuilder Enterprise

BY DAVID S. LINTHICUM

Today, the name PowerBuilder is almost synonymous with client/server development for Windows, an impressive feat given the huge number of competing tools. Working with PowerBuilder Enterprise, Version 3.0a, shows that its sterling reputation is no accident.

PowerBuilder has a multitude of strengths, including a consistent, highly productive development environment with powerful GUI programming tools, strong reporting and business graphing, good database-administration features, and broad back-end connectivity. Once you've mastered it, you'll be able to turn out handsome client/server applications with lots of impressive Windows bells and whistles in a minimum of time.

Although PowerBuilder is not fully object oriented, it supports many object-oriented features, including inheritance, polymorphism, and, to some extent, the concept of classes. This system fosters a high degree of code reuse and lets you



PowerBuilder lets you define extended database attributes that are reflected throughout your application.

leverage the supplied library of PowerBuilder objects effectively. While this release limits you to Windows development, Version 4.0 should add support for Macintosh, Windows NT, and several Unix platforms. PowerBuilder breezed through our test application with a minimum of coding. The only problems we encountered were a handful of minor bugs that intermittently crashed the development system.

RAD Tools: A Rapidly Developing Category

As interest in client/server computing has escalated, tools for rapid development of SQL front-end applications have multiplied. This table lists tools that were not shipping in time to be reviewed, had not been revised since our last

roundup, or otherwise did not make our main roundup. They range from high-end, multiplatform, rapid development environments to smaller-scale tools. All information was supplied by the vendors.

Product	Company	List price	Deployment platforms	SQL engine included	In short
AM (Applications Manager), Version 4.3	Intelligent Environments Inc., 2 Highwood Dr., Tewksbury, MA 01876; 800-889-2797, 508-840-1080; fax, 508-840-1090.	\$8,400	OS/2, Windows NT	Yes	AM is a development environment for the rapid creation of client/server applications with support for the entire development cycle, including object-oriented GUIs, logic coding and testing, and deployment.
CA-OpenRoad/Windows4GL 3.0 for Windows NT	Computer Associates International Inc., One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-5224; fax, 516-342-5734.	\$6,720	OS/2, Unix, Windows, Windows NT	No	An object-oriented 4GL environment for developing graphical client/server applications, OpenRoad combines GUI usability with advanced object orientation.
CA-Visual Objects, Version 1.0	Computer Associates International Inc., One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-5224; fax, 516-342-5734.	\$500	Windows NT	Yes	CA-Visual Objects is an object-oriented development system for creating both applications and DLLs; it includes visual design tools, object-oriented code generators, an active repository, and browsers.
C/S Elements, Version 1.02	Neuron Data Inc., 156 University Ave., Palo Alto, CA 94301; 800-876-4900, 415-321-4488; fax, 415-321-9648.	\$6,850	Macintosh, OS/2, Unix, Windows NT, others	No	C/S Elements is an object-oriented, cross-platform development tool that includes GUI development and extensible scripting features. It accesses multiple flat-file and relational data sources and is portable to more than 40 deployment platforms.
DataEdit, Version 2.1	Brio Technology Inc., 444 Castro St., #700, Mountain View, CA 94041; 800-486-2748, 415-961-4110; fax, 415-961-4572.	\$899	Macintosh, Windows	No	DataEdit is a graphical development tool for building on-line forms that requires no programming or SQL coding.
ESL for Windows, Version 4.0	Easel Corp., 25 Corporate Dr., Burlington, MA 01803; 800-525-1411, 617-221-2100; fax, 617-221-6899.	\$6,500	Windows	No	A set of tools for rapid development of client/server applications that is based on Easel's ESL programming language. ESL for Windows includes a visual tool that provides reusable code libraries and dynamic code generation.
Focus Professional for Windows, Version 1.1	Information Builders Inc., 1250 Broadway, 30th floor, New York, NY 10001; 800-969-4636, 212-736-4433; fax, 212-967-8408.	\$3,495	Windows, Windows NT	No	Focus Professional is an object-oriented applications-development system for creating client/server Windows runtime applications; includes Object Browser, Application Packages, and templates for popular DBMS interfaces.
Gembase, Version 5.2	Ross Systems Inc., 555 Twin Dolphin Dr., Redwood City, CA 94065; 404-851-1872; fax, 404-257-0434.	Pricing not available at press time	Windows	No	Gembase is an applications-development environment designed to build enterprise-wide, mission-critical applications; it is portable across multiple servers.
Informix-NewEra, Version 1.0	Informix Software Inc., 4100 Bohnannon Dr., Menlo Park, CA 94025; 800-331-1763, 415-928-6300; fax, 913-598-8753.	\$4,495	Windows	No	This package is a graphical, object-oriented, client/server development environment that includes a database application language, visual programming tools, support for team development, and reusable class libraries.
JAM, Version 6.0	JYACC Inc., 116 John St., 20th floor, New York, NY 10038; 800-458-3313, 212-267-7722; fax, 212-608-6753.	\$2,000 and up	DOS, OS/2, Unix, Windows, others	Yes	A multiplatform applications-development tool that integrates visual programming and repository-driven development, JAM, which targets OLTP applications, accesses 15 SQL databases.
KASE-VIP for O/2, Version 2.0; KASE-VIP for Windows, Version 4.0	KASE Systems Inc., One Meca Way, #150, Norcross, GA 30093; 404-584-5698; fax, 404-584-5679.	\$1,995 (OS/2), \$995 (Windows)	OS/2, Windows	No	KASE-VIP is a visual design and code-generation tool for building GUIs and client/server applications in either Windows or OS/2 Presentation Manager.
Magic, Version 5.6	Magic Software Enterprises Inc., 1200 Main St., Irvine, CA 92714; 800-345-6244, 714-250-1718; fax, 714-250-7404.	\$2,000	DOS, Windows	No	A rapid applications-development tool designed for mission-critical applications, Magic supports class inheritance and encapsulation.
Natural for Windows, Version 2.13	Software AG of North America Inc., 11190 Sunrise Valley Dr., Reston, VA 22091; 800-423-2227, 703-860-5050; fax, 703-391-6731.	\$7,500	OS/2, Unix, Windows, others	Yes	This product is a Windows version of the Natural 4GL development environment and includes Software AG's Adabas database engine. The product offers visual development and source-code portability across several operating systems.
Object/1, Version 3.0	Micro Data Base Systems Inc., 1305 Cumberland Ave., West Lafayette, IN 47906; 800-445-6327, 317-463-7200; fax, 317-463-1234.	\$4,000	DOS, OS/2, Windows	No	Object/1 is a graphical development environment that offers an object-oriented programming language, a forms painter, and an open architecture.
ObjectPro, Version 1.0	Trinzic Corp., 101 University Ave., Palo Alto, CA 94301; 800-234-7724, 415-328-9595; fax, 415-321-7728.	\$2,995	Windows	No	This product is a full-scale object-oriented system that allows users to build and reuse entire business models and apply objects to screen development.
Omnis 7 ³	Blyth Software Inc., 989 E. Hillside Blvd., #400, Foster City, CA 94404; 800-346-6647, 415-571-0222; fax, 415-571-1132.	\$5,000	Macintosh, OS/2, Unix, Windows, Windows NT, others	Yes	A client/server development environment with multiplatform support, Omnis 7 ³ features a template-driven prototyping tool for rapid design and development and an object-based graphing tool.
ORIN for Windows, Version 2.51	Objective Solutions Inc., 17 Hibiscus Blvd., #106, Melbourne, FL 32901; 407-876-0279; fax, 407-729-0875.	\$3,750	Windows	No	ORIN is a client/server applications-development system that uses visual programming and an object-oriented approach to build portable, mission-critical systems.
Progress, Version 7.0	Progress Software Corp., 14 Oak Park, Bedford, MA 01730; 800-831-0098, 617-280-4000; fax, 617-280-4095.	\$2,900	Unix, Windows	Yes	Progress is an applications-development environment designed for cross-platform deployment and database-independent connectivity.
SuperNOVA, Version 3.3	Four Seasons Software, 2025 Lincoln Hwy., Edison, NJ 08817; 800-949-0110, 908-248-6667; fax, 908-248-6675.	\$1,740	Unix, Windows	No	A database-independent, object-oriented, distributed-processing 4GL tool that provides an interactive, portable development environment, SuperNOVA supports several network protocols and GUI standards.
Uniface, Version 6.0	Uniface Corp., 1320 Harbor Bay Pkwy., Alameda, CA 94502; 800-365-3608, 510-748-6145; fax, 510-748-6150.	\$4,400	Macintosh, OS/2, Unix, Windows, Windows NT, others	No	Uniface is a client/server development environment that employs a model-driven approach designed for building enterprise-scale business applications. It includes graphical, object-based rapid applications-development and team-development options.
Visual Basic, Version 3.0, Professional Edition	Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-862-8080; fax, 206-838-7329.	\$340	Windows	No	One of the original visual development tools, VB provides basic visual tools for SQL front-end development. But without third-party controls, VB requires a lot of coding.
VisualWorks for Windows, Version 2.0	ParcPlace Systems Inc., 999 E. Arques Ave., Sunnyvale, CA 94086; 800-759-7272, 408-481-9090; fax, 408-481-9095.	\$2,995	Macintosh, OS/2, Unix, Windows, Windows NT	No	A pioneering client/server tool for building portable applications using object-oriented programming, VisualWorks includes a database application creator, a GUI builder, and ParcPlace's Smalltalk language.
VX-REXX Client/Server Edition, Version 2.1	Watcom International Corp., 415 Phillip St., Waterloo, Ontario, Canada N2L 3X2; 800-265-4565, 519-886-3700; fax, 519-747-4971.	\$299	OS/2	No	This is a REXX-based applications-development package with visual tools for designing database queries and building client/server applications for OS/2.



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■ Borland's Delphi: *A Promise of Power*

By Gabrielle Gagnon

Delphi is the code name for a secret weapon that Borland International plans to launch early in 1995. Designed as a direct competitor to Microsoft Visual Basic, Delphi is a visual programming environment targeted at professional developers who want an easy-to-use, object-oriented RAD tool that doesn't compromise on power or performance. While Delphi will be a general-purpose tool, a specialized edition for client/server front-end development will be included in the first release. At this writing, Delphi is still in early beta testing, but what we've seen so far looks highly promising.

PASCAL, NOT BASIC

Unlike many RAD tools, which use some version of the BASIC language, Delphi is based on Object Pascal. This is an object-oriented extension of the procedural Pascal language that many would argue is easier to learn and use than C++. Borland's implementation of Object Pascal is different from the original Object Pascal introduced by Apple in 1984. Most notably, Borland's implementation does not permit the overriding of methods unless the class is declared as Virtual. Borland says this was done for performance reasons since most methods are not overridden, but Object Pascal purists may object to this approach.

Unlike most competing visual development systems, Delphi also includes a true compiler. The user will be able to generate standalone machine-language .EXE files or DLLs that can be called by other applications. Borland expects that compiled Delphi applications will have a significant performance advantage over tools such as Visual Basic or Powersoft's PowerBuilder, since these products generate pseudo-code programs that must be partially interpreted at runtime. While we did not run

performance tests on Delphi, significant performance gains are to be expected with pure machine-code executables. Delphi automatically compiles individual components as you add them to your interface. We did not experience any noticeable compilation delay before being able to test an application.

Borland has put its years of experience with compilers and debuggers to good use in Delphi. The product is

chock full of programming aids that take full advantage of the GUI environment. Aside from state-of-the-art testing and debugging tools, Delphi adds an innovative twist to visual programming with two-way code generation. While many visual

programming tools will generate source code from a visual object, Delphi goes further by automatically regenerating visual objects when you edit the source code. You can even cut a piece of Pascal code into the clipboard and paste it to your interface as an object (and vice versa). This ensures that your visual interface and the background code are always synchronized regardless of the modifications you make.

While you can use Delphi to develop high-performance executables, you can also generate your own custom controls for reuse with Delphi or with other development tools. In addition to standard Windows and graphics controls, Delphi supplies DDE, OLE 1.0 and 2.0, and OpenDoc objects that you can embed in your applications. You can also import third-party controls in the form of DLLs, or you can use Visual Basic .VBX custom con-

trols. This alone gives developers access to a huge supply of prewritten functionality.

The initial release of Delphi will appear in two flavors: an Enterprise SQL Edition for Windows and a Standalone PC Edition for Windows. Borland expects 32-bit versions of both packages to ship for Chicago, soon after it is released. Both varieties will include the Borland Database Engine (BDE) currently deployed in

Borland's dBASE for Windows 5.0 and Paradox 5.0. The Enterprise Edition, which we saw in beta, will use the BDE to consolidate data drawn from remote SQL servers. Currently, the BDE offers ODBC



Borland's new Delphi environment will offer a true optimizing Pascal compiler.

connectivity and direct API support for Borland's Interbase, Oracle7, and SQL Server. Team development tools and the SQL Server version of Borland's ad hoc query tool ReportSmith for Windows 2.0 will also be included in the Enterprise edition. Pricing was not available at press time.

EASY TRANSITION

Veteran Borland language users will find the transition to Delphi's environment especially easy. Delphi has the same editor and debugging kernel found in Borland's C++ 4.0, and Delphi's compiler is a superset of the one used in Borland's Pascal 7.0. If you prefer other tools, you have the option of plugging in your own favorite editor and Borland's Turbo Debugger (which is sold separately). The Enterprise Edition has team development tools that work with Delphi's built-in version control or with Intersolv's PVCS

version-control package. The Delphi IDE has an open API so that other third-party tools may be added in the future. An interface with popular CASE tools for object-oriented data modeling is already planned.

Delphi's Integrated Development Environment (IDE) combines a Windows MDI interface with a tabbed-notebook metaphor. When you call up the IDE, two sets of toolbars, which Borland calls Speedbars, appear beneath the main menu. On the left are icons for standard Windows operations such as File Open, Copy, Cut, and Paste, and on the right is the Component palette, a set of overlaid, tabbed speedbars organized by object category. To access a standard Windows component such as a pushbutton or a list box, you click the Standard tab and a single row of icons representing the standard Windows widgets is displayed on top. Other tabs exist for specialized database components and custom objects that you can create in Delphi or import as DLLs or .VBXs. If the number of icons or the number of tabs exceed the display width, a horizontal scrollbar appears and you can scroll to the object you want.

Speed bars and other icons are abundant in Delphi and are generally used to good effect, but we would like to see some text explaining each icon, either as pop-up help or as a balloon hint displayed when the cursor passes over it. Nevertheless, Borland's use of tabbed notebooks is a good solution to the problem of managing a burgeoning amount of application elements.

Equally good is the way Delphi handles imported objects, particularly .VBXs. With just a few keystrokes, any .VBX control can be seamlessly integrated into the development environment. When a .VBX is imported, it is automatically added to the component palette. Its properties and the events to which it responds are listed in the Object Inspector, and it becomes indistinguishable from a native Delphi control. This is true to a lesser extent with DLLs, although

these do not provide enough information to be added to the Object Inspector.

Since all objects are extensible in Delphi, an imported .VBX has more flexibility than in its native Visual Basic environment. Delphi shares this advantage with other object-oriented development environments that import .VBXs and custom DLL controls as object classes. Once a .VBX or DLL becomes a class, it can be subclassed and can inherit or override behavior just like any other subclass. Although the modifications one can make to a .VBX or DLL are limited to its public variables and methods—everything else is encapsulated—developers still have the ability to customize these objects to some extent. This is impossible in Visual Basic, which does not support classes.

Although Delphi wasn't ready at this writing, Borland plans to equip it with a visual query generator to produce ANSI-standard SQL statements that you can edit or enter manually. You will be able to configure the syntax checker to accept database-specific dialects of SQL as well. The visual query generator is expected to be similar to the one that currently ships with ReportSmith. Borland acquired ReportSmith earlier this year, and at this point ReportSmith has connectivity to more data sources than Delphi itself. In addition to ODBC support and direct API drivers for Interbase, Oracle, and SQL Server, ReportSmith for SQL Server has native drivers for SQLBase, Ingres, and Unify, as well as access to DB2 and Teradata via the MDI Gateway.

Delphi's powerful object-oriented language, its ability to use and subclass existing controls, and its capability of generating true machine-language executables add up to a formidable array of features. If it delivers on most of its promises, Delphi will be a fine addition to the growing number of high-performance, object-oriented development tools available for Windows. □

GREAT PAINTERS

The PowerBuilder development environment is organized around a set of well integrated graphical tools called Painters. These let you design, build, test, and deploy applications in an intuitive visual environment. Painters are provided for building application components such as windows, menus, queries, reports, or custom user objects. They also address physical database design, application testing and debugging, and, most importantly, management and reuse of application objects.

The Database Painter provides tools for designing and implementing a database on any supported server. You can create tables, indexes, and views; assign primary and foreign keys; execute database script files; and control security and access to data. A graphical display of the

	SUITABILITY TO TASK	
	Power	Ease of Use
Connectivity	EXCELLENT	EXCELLENT
Professional development	GOOD	EXCELLENT
DSS/reporting	GOOD	EXCELLENT
Prototyping/quick development	EXCELLENT	EXCELLENT

database schema shows tables and their columns with primary and foreign keys indicated by icons. PowerBuilder stores extended attributes on the database server. Extended attributes are reflected throughout your application, although subsequent changes are not automatically propagated.

PowerBuilder provides links to most major databases including Informix, Oracle, Sybase, XDB, and ODBC-compliant databases. For off-line development or prototyping, PowerBuilder includes a Windows version of Watcom SQL. While this is a nice addition, developing applications against your actual target server can avoid a number of headaches.

Not surprisingly, windows are the basic building blocks of a PowerBuilder user interface. The Window Painter is a highly efficient tool that lets you build new windows from scratch, modify existing windows, or create a new window from an existing one by way of inheritance. You can place a variety of controls in windows, including check boxes, command buttons,

DataWindows, Edit masks, picture buttons, scroll bars, drop-down list boxes, graph objects, and picture boxes.

The Window Painter offers a preview facility, and it stores the finished windows in the PowerBuilder library. Multiple Document Interface (MDI) applications are supported as are BLOBs via OLE 1.0. You can also place .VBX 1.0 controls in windows.

POWER THROUGH DATAWINDOWS

PowerBuilder's powerful DataWindows, a specialized window type, are data-aware controls that can handle data input and output, as well as data validation, and provide sophisticated report-style visual presentation. Learning to use these controls well is one of the keys to mastering PowerBuilder. DataWindows are created through the DataWindows Painter, a visual editor for specifying such things as presentation styles, data source, data-display formats, filters, sort orders, and validation rules. DataWindows should be used in favor of other controls whenever possible, as they offer a number of intelligent features for optimizing data access and maximizing client resources.

Most developers will use the DataWindow Painter for report writing (the dedicated Report Painter appears identical to the DataWindow Painter). You can create complex band-oriented tabular, crosstab, free-form, label, and multi-column reports with support for grouping, sorting, calculated fields, and totals. The integrated business graph facilities, also accessed via the DataWindow Painter, let you use a large variety of graph types including 2-D, 3-D, bar, column, pie, line, area, scatter, and custom.

The Library Painter lets you manage individual objects that make up your PowerBuilder application through a tree-listing of objects or through a hierarchical display of their inheritance structure.

With Version 3.0a, PowerBuilder also provides the Client/Server Open Development Environment (CODE), an open API for integrating PowerBuilder's library manager with third-party products such as CASE tools. To facilitate team development, PowerBuilder provides basic check-in/check-out features and directly supports Intersolv's PVCS version-control software, a separate purchase.

FACT FILE

PowerBuilder Enterprise, Version 3.0a



List price: \$3,395 **Requires:** 386-based PC or better, 4MB RAM, 16MB hard disk space, Microsoft Windows 3.1 or later
In short: PowerBuilder lives up to its reputation as a full-featured front-end development tool that gets the job done

quickly. Its quasi-object-oriented environment promotes efficient component reuse. You work with easy-to-use "painters" for creating application components. The PowerScript 4GL lets you control the behavior of most objects. Although PowerBuilder suffers from a few bugs and is a Windows-only solution, it delivers impressive results.

Powersoft Corp., 561 Virginia Rd., Concord, MA 01742; 800-273-2841, 508-287-1500, fax, 508-369-3997

461 on reader-service card

While you can build all application objects from scratch, PowerBuilder ships with an Application Library containing a variety of useful prebuilt objects. It really pays to browse through this library, or you could end up reinventing the wheel. Several third-party vendors also sell PowerBuilder object libraries.

BY THE SCRIPT

After creating your visual objects, you'll need to define their behavior. PowerBuilder uses an event-driven processing model, and responses to events are defined by a programmatic script written in PowerScript, PowerBuilder's BASIC-like programming language. PowerScript is a high-level, strongly typed language with some object-oriented features.

The PowerScript Painter is used to create scripts, and you can attach a PowerScript module to any PowerBuilder object. These modules can also provide relational database processing through embedded SQL and stored procedures. PowerScript supports many data types, including Boolean, Data, Time, Character, and most types of numerical data. If you make a coding error, the debugger helps you find and fix problems by allowing you to set breakpoints, single-step

through a script, and view and change variables on the fly.

Once a script is complete, the PowerScript Painter automatically compiles it, checking for syntax errors along the way. Each compiled script is encapsulated inside the object it controls and is stored inside the PowerBuilder library like other applications components. Finished applications compile to tokenized pseudo-code and can be distributed as single .EXEs or as multiple dynamic libraries along with PowerBuilder's royalty-free runtime engine.

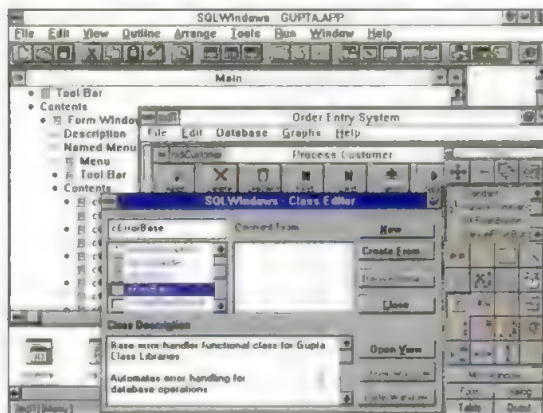
PowerBuilder lives up glowingly to its reputation as the client/server megatool. Its powerful painters and effective reuse of application components deliver on the promise of rapid applications development: impressive GUI applications in record time.

Gupta Corp.

EDITORS' CHOICE SQLWindows Corporate Edition

BY MARK S. CHILDERS

In the competitive world of client/server development tools for Windows, Gupta Corp.'s SQLWindows has long been known as one of the best. The new SQLWindows Corporate Edition, Version 5.0, expands the product's already rich feature set and solidifies its robust object-oriented development environment.



SQLWindows' object classes can be used unchanged, or you can inherit from them to create your own classes.

Important enhancements include QuickObjects, a set of powerful classes and visual tools that speed application prototyping and development. SQLWindows

also tackles the problem of poor 4GL performance by letting you output finished application components as C source code. Once compiled with a third-party C compiler, your application should run significantly faster than the pseudo-code .EXEs generated by most competitors.

SQLWindows ran friction-free through our tests. We ran into a few general protection faults, but SQLWindows handled them gracefully, letting us save our work to a new file name before restarting.

WORK ENVIRONMENT

Developers who have worked with other 4GL systems may find SQLWindows' user interface somewhat unusual. The main work area is the Outline Window, a central location where you edit all aspects of the application. It's here that you write source code, declare local and global variables, define classes, and set object properties. Visual tools are also available for building windows graphically. You can populate your forms with table objects, standard windows controls, and QuickObjects, simply by selecting any of these from a floating tool palette and dragging them onto your form. SQLWindows also supports the use of Microsoft Visual Basic controls and Windows custom controls.

C++ developers will find SQLWindows' object-oriented methodology familiar. SQLWindows is one of the few 4GL tools to support multiple inheritance and implements classes, single inheritance, and polymorphism. When using multiple inheritance, however, you must be careful to resolve conflicts between attributes, functions, or message actions defined in multiple ancestor classes.

SQLWindows ships with a number of useful object classes, but for most applications, you'll want to enhance and extend their functionality and actions. For this task, SQLWindows offers SAL (SQLWindows Application Language), a powerful language that should meet the demands of most developers. SAL provides support for all the basic Windows control events and for DDE and OLE 1.0 (client and server). It also lets you make external DLL function calls or calls to the Win-

dows API. But if you aren't careful with exact spelling, SAL's complex syntax and case sensitivity can lead to numerous compiler errors.

SQLWindows offers one of the most robust debuggers we've seen in an SQL application development tool. It supports breakpoints, watchpoints, watch variables,

stepping, tracing, and animation. The debugger even lets you spy on Windows messages being passed to the application. The flow of messages can be a bit staggering, but you have

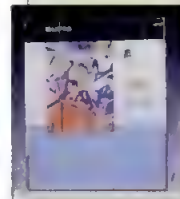
the option of restricting the display to SAMs (SQLWindows Application Messages). Another nice feature is the debugger's ability to display the function-call tree via the stack-trace window. The debugger can be engaged immediately with a single keystroke while you're running an application in the development environment.

Application performance is one area

where 4GL development products such as SQLWindows have typically come up short. The fault lies with the supplied compilers, which produce tokenized pseudo-code (p-code) executables instead of generating true machine code. A new

FACT FILE

SQLWindows Corporate Edition, Version 5.0



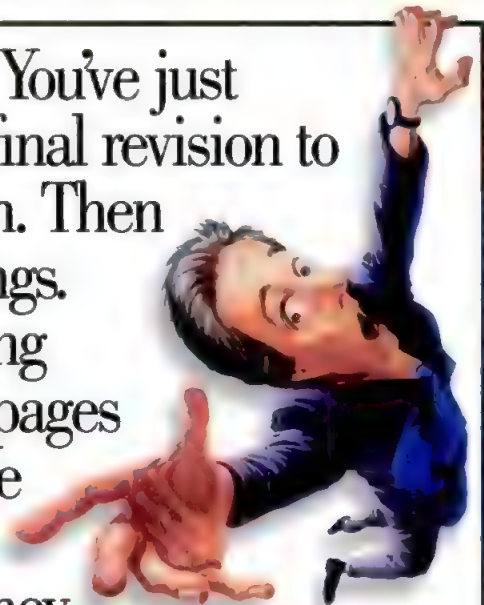
List price: \$2,995 **Requires:** 386-based PC or better, 4MB RAM (8MB recommended), 24MB hard disk space, Microsoft Windows 3.1 or later **In short:** The latest SQLWindows adds QuickObjects (object classes that can be used as building

blocks), enables rapid development, and includes a strong set of SQL drivers. The new compiler produces C source code that compiles to a true .EXE using Microsoft Visual C++ 1.5. The debugging tools are some of the most robust we've seen. This fully revamped product takes programmer productivity and application performance a step above the rest.

Gupta Corp., 1060 Marsh Rd., Menlo Park, CA 94025, 800-876-3267, fax, 415-321-5471

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It's 3:50 pm. You've just finished the final revision to the sales plan. Then the phone rings. "We're sending over 10 new pages of competitive info." Click. Good thing they lock the windows on this floor. You have to get it into the plan by the end of the day. What now?



addition to SQLWindows, the SQLWindows Compiler, sidesteps this bottleneck by letting you generate C source code from your finished SQLWindows application. When compiled with a third-party C compiler, the resulting program will have the speed advantages of a 3GL application. The SQLWindows Compiler produces source code for Microsoft Visual C++ (a separate purchase). You don't need to be a C programmer to take advantage of this feature, and, since you can't view the generated code, it doesn't even help to be one. The current release only lets you convert certain portions of the application to C code: specifically, global internal functions. These are compiled to a DLL which is called by a main executable. Future releases will allow a complete conversion to C (support for Borland C++ is also planned). Microsoft Visual C++ is not required; you can still create a p-code executable within the product.

QUICK OBJECTS

The demand for speedier development has also been addressed by SQLWindows' host of new "Quick" visual modules: QuickObjects, QuickForms, QuickGraphs, and QuickMenus. QuickObjects, the underlying technology, are object classes that can be used as the building blocks for your application. QuickObjects can be used unchanged or inherited to form the basis of your own classes. For example, the Mail QuickObject allows you to enable your application for most of the popular e-mail systems in a matter of a few mouse clicks. A QuickObject for Lotus Notes is also supplied. QuickObjects will not only free the experienced developer from the chore of coding base classes but aid the novice SQLWindows programmer as well.

QuickForms is a wizard-like tool that walks you through the process of building a basic form composed of QuickObjects. A great deal of functionality is available without programming. For example, we were able to create a fully functional master/detail form containing a toolbar without a line of code. QuickGraphs let you drag graph objects onto a form while linking them to a data source. Once you have a QuickGraph on the form, you can define the graph type and display defaults via a toolbar on the object. This toolbar

can be left enabled in the final application to let your users change the graph characteristics at run time. QuickMenus, a graphical menu builder, lets you build fully functional menus without writing any code. SQLWindows also ships with Visual Tool Chest, a useful third-party class library containing controls, redefined functions, and a variety of widgets.

Since a large portion of client/server projects are done by teams of developers, software configuration management has become an important issue. SQLWindows addresses this with a bundled product called Team Windows. More than a simple check-in/check-out system, Team Windows is a full repository-based version-control system that includes support for non-SQLWindows files. The Team Windows repository can be stored in Gupta's SQLBase, Oracle Corp.'s Oracle7, Microsoft's SQL Server, and Sybase's SQL Server. It can also reside as an Intersolv PVCS archive.

SQLWindows' full-featured report writer is template-based. Report templates are reusable with minimal coding since the data source is not necessarily tied directly to the report itself.

SQLWindows ships with all of Gupta's SQLRouter database drivers at no extra cost (except for DB2, which is available as an extra-cost option). These drivers allow connection with SQLBase, Oracle, Sybase, Informix, Ingres, and ODBC-compliant data sources.

Gupta's SQLWindows continues to set standards for Windows-based client/server development tools. The addition of the SQLWindows Compiler and QuickObjects to this impressive new release bring programmer productivity and application performance to new heights.

Symantec Corp.

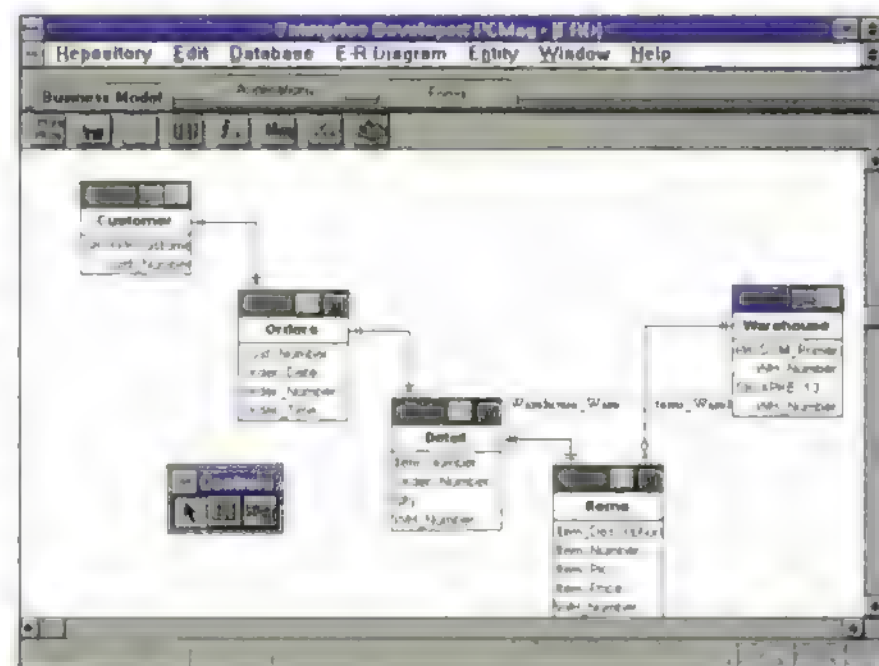
● Team Enterprise Developer

BY MARK S. CHILDERS AND BRIAN BUTLER

Symantec Corp.'s Team Enterprise Developer, Version 1.0, may be a latecomer to the client/server arena, but its innova-

tive approach deserves your attention. The key to its considerable power is Symantec's innovative Scalable Architecture for Large Enterprises (SCALE)—four separate layers that cleanly isolate the physical data sources, the business model, transaction-processing optimization, and front-end application logic. Exploiting this architecture will let you build highly functional applications in a minimum of time.

The database layer isolates the client application from the physical location of the data. At the heart of the second layer, the business model, is a repository containing *metadata*—data about data. This consists of an E-R (Entity-Relationship)



Time spent up front creating a business model pays off in easy forms and reports generation.

model, information on how to locate the defined data (the Data Road Map), and the business rules of the enterprise. A powerful E-R modeling tool also lets you reverse engineer an existing database as well as create new tables. The transaction layer manages and optimizes the processing of queries and updates. Finally, the application layer is the specific program the developer writes. This is where your forms, windows, and menus reside.

Enterprise Developer includes a Symantec-specific version of XDB's SQL database engine as a generic back end for working when you're off the network. ODBC connectivity is included and drivers for a wide range of SQL databases are available as options. The product went through our testing script with impressive efficiency, even though we had to code the required crosstab report by hand.

If you've worked with other 3GL or 4GL tools, Enterprise Developer's busi-

SUITABILITY TO TASK

Team Enterprise Developer

	Power	Ease of Use
Connectivity	GOOD	GOOD
Professional development	GOOD	GOOD
DSS/reporting	FAIR	GOOD
Prototyping/quick development	EXCELLENT	GOOD

ness-model orientation may take a little getting used to. But once you've mastered it, you can produce applications very efficiently. You'll find yourself spending more time up front on defining the business model, but if you lay out the repository entities properly, the Form Builder will generate forms for you with little or no coding.

The E-R diagram, created by the Data Modeler tool, shows the layout of your business model. It consists of entities, their relationships, and indexes. Entities, a key concept in the business model, are business-oriented representations of the underlying physical database tables. Relationships can be key- or repository-based. Key-based relationships can be construed as primary- and foreign-key definitions that reside and are enforced in the server. Repository-based relationships can also be defined across different databases, establishing heterogeneous joins. Referential integrity can be defined when defining the relationship and will be enforced by the SCALE transaction processor.

INTEGRATED EDITOR

Once you've defined the business model, generating forms for data entry or reporting is an easy task. A graphical forms builder and an editor are integrated into the environment. When you create a new form, Enterprise Developer steps you through the process, giving you the opportunity to select the database table columns, related columns, form style, and the number of records to be displayed at one time. The order in which you select columns is the order in which they'll be laid out on the form. Next, Enterprise Developer automatically generates a basic input screen with a functional toolbar and menu. Record drill-down and tabular views, accessible from the toolbar, can be added automatically.

The graphical environment offers a tool palette from which you can select controls for placement on your form. You can easily change control attributes by using the right mouse button. Symantec gives you quite a bit of control over visual attributes, down to the ability to specify the thickness of the 3-D shadow on screen objects. You can also edit the form's menu and toolbar with graphical editors. It's obvious that a lot of thought and effort have gone into designing the Enterprise Developer interface, which uses a tabbed folder metaphor throughout.

Symantec has implemented style templates to help you maintain a common look and feel throughout an application. Forms can inherit styles and any changes to the base style sheet will ripple through all inherited forms. Currently, this release doesn't support the use of Visual Basic or Microsoft Windows custom controls.

POWERFUL LANGUAGE

There will be times when you need to extend the basic functionality of your form. For this, Symantec provides SCALE-

▶ FACT FILE

Team Enterprise Developer, Version 1.0



List price: \$1,795 **Requires:** 386-based PC or better, 12MB RAM, 12MB hard disk space, Microsoft Windows 3.1 or later.
In short: Team Enterprise Developer is a highly robust environment, especially for a 1.0 release. Its business model—ori-

ented architecture may require getting used to, but time spent up front lets you produce applications efficiently with very little coding. The product's language, which resembles C++, provides plenty of power. Developers have considerable control over GUI attributes. Some advanced functions are missing, but the underlying structure is well designed.

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014, 800-441-7234, 408-253-9600, fax, 408-446-9750

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Script, a powerful language whose syntax resembles C++. With SCALEScript, you define methods—referred to as scripts in other tools—that center around Windows events. You can also create your own

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TYPE	Mono VGA	Color Mac™	SVGA	FVGA	FVGA	FVGA	Hi-Res
DOT PITCH	N/A	.28	.28	.28	.28	.31	.31
SCAN RATE H	31.5KHz	35.0KHz	31.5 35.2 35.5	30-48KHz	30-66KHz	30-58KHz	30-64KHz
SCREEN	Non-Glare	Glossy	Non-Glare	Non-Glare	Non-Glare	Non-Glare	Glossy
MFG. SUG. RETAIL	\$119	\$299	\$269	\$299	\$399	\$749	\$1,199

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functions and properties as well as define new methods. A series of useful finance-oriented functions such as Presentvalue and Futurevalue are incorporated into the language, and you can extend its functionality with external DLL function calls. Enterprise Developer is an object-oriented development system that supports classes and single inheritance.

All SCALEScript functions are documented in the on-line help system and in a separate manual. The documentation itself is somewhat lacking in organization, however. This is unfortunate, considering how unfamiliar Enterprise Developer's approach will be to users of other 4GL environments.

Building a report in Enterprise Developer is basically the same as building a form. Symantec clearly has some more work to do in this area since some advanced features, such as crosstabs, aren't yet supported. Graphing capability is available but limited since graphed data must be in a database column. Since you can't graph data based on an arithmetic expression, you'll need to create virtual columns in the database based on the expression in order to graph it. We also found the pie chart inadequate during testing. Symantec plans to address these limitations in the next release.

The product's fully functional debugger can be invoked at any time when running a form or application. An additional logging feature also lets you spy on all the SQL statements going to the database. This unusual capability should prove valuable for both debugging and tuning.

When generating a final executable, you have several options not available in other 4GLs. You can specify exactly which forms you want included in the application, and you can choose to place the repository definitions in the application or on the server. Centralizing the business rules gives you the option of updating the client applications automatically after any change to the server-based repository.

Connectivity to supported databases—which include Oracle7, Sybase SQL Server, Microsoft SQL Server, and DRDA (DB2, DB2/2, AS/400)—is provided by optional SCALE Data Links. Connectivity to ODBC-compliant data sources (with enhanced drivers for XDB and Watcom), is bundled free. SCALE Data

Links provide all the database engine-specific information needed by the repository and let the Transaction Processor exploit the native capabilities of each database engine.

Enterprise Developer's underlying architecture and methodology are well thought out and make for highly productive development. We found the environment to be amazingly robust for a 1.0 release, and the product had no trouble completing our test application. Rough spots remain in a few areas, such as reporting and graphing, but given a little time, Enterprise Developer will definitely be a major contender in the SQL front-end market.

Unify Corp.

• Unify Vision Enterprise

BY ARTHUR PERLEY

Unify Vision Enterprise, Version 1.1, from the veteran Unix tools company Unify Corp., is a relatively new front-end development tool. It has some considerable attractions but also some surprising

weaknesses, both of which seem to stem from its Unix heritage.

Unify Vision's biggest strength is as a cross-platform development system in environments running both Microsoft Windows and Unix. Applications created in

SUITABILITY TO TASK		
Unify Vision Enterprise		
	Power	Ease of Use
Connectivity	GOOD	GOOD
Professional development	EXCELLENT	EXCELLENT
DSS/reporting	POOR	POOR
Prototyping/quick development	GOOD	GOOD

Windows 3.1, Windows NT, or on most standard Unix operating systems supporting Motif or Open Look can be migrated transparently to the other supported platforms without recompilation. The look and feel of each platform is maintained through the use of native interface objects.

The product's slick development environment has a good suite of point-and-click visual tools for creating transaction-

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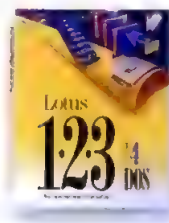
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► SUMMARY OF FEATURES

CONTINUES

SQL Front Ends



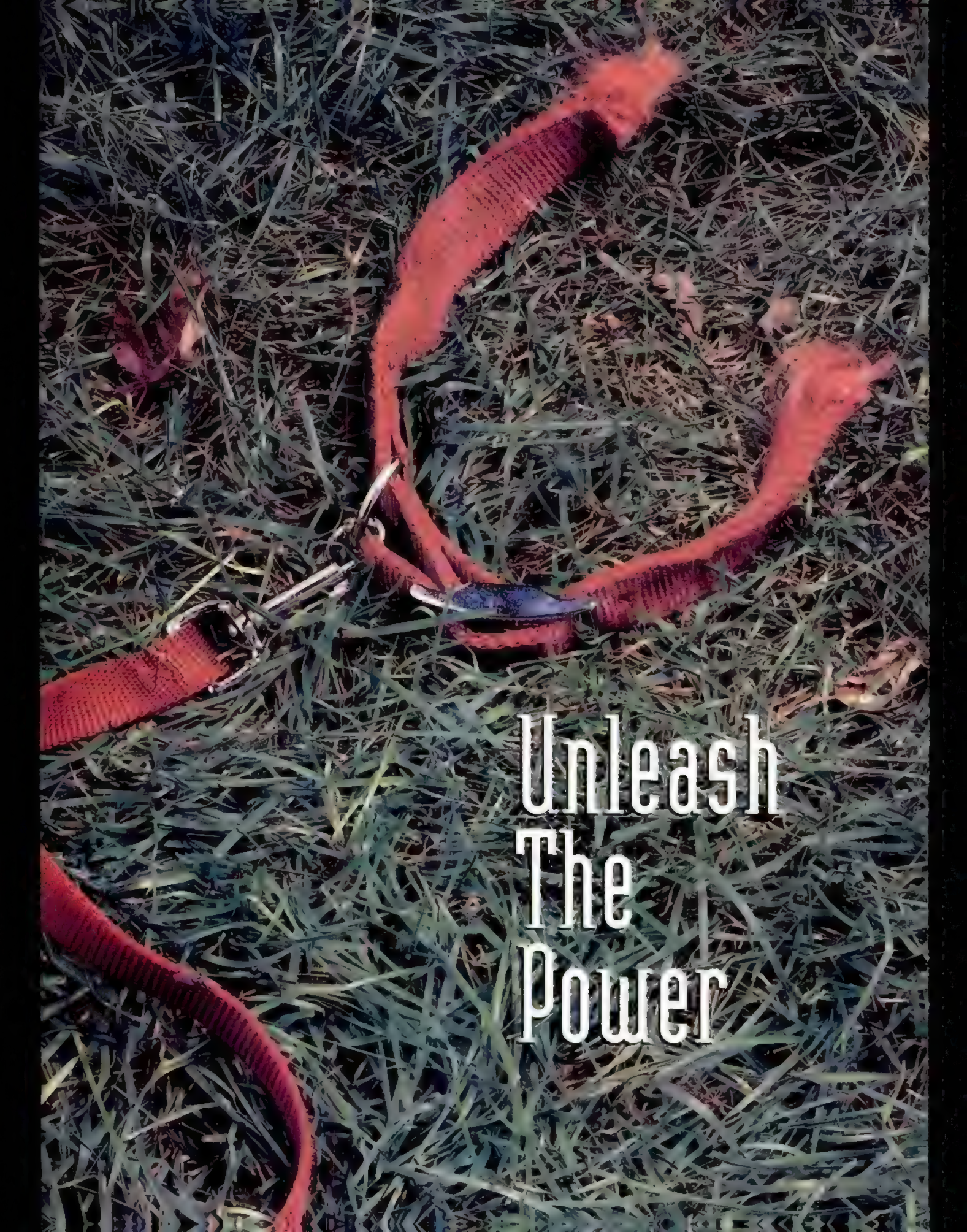
Products listed in alphabetical order

■ = YES □ = NO

	Object Studio	ObjectView Enterprise 3.01	PARTS	PowerBuilder Enterprise 3.0a	SQLWindows Corporate Edition 5.0	Team Enterprise Developer 1.0	Unify Vision Enterprise 1.1	VisualAge Team for OS/2 1.0
List price	OS/2 version, \$16,500 ^① Windows version, \$12,900 ^①	\$3,200	\$5,995 ^②	\$3,395	\$2,995	\$1,795	\$3,995	\$5,990 ^③
Tested platform(s)	OS/2, Windows	Windows	Windows (Win32)	Windows	Windows	Windows	Windows	OS/2
Other platforms available	None	None	OS/2, Windows NT	None	None	None	Unix, Windows NT	None
Format Support								
Native SQL back-end support:								
DB2	□	□	□	□	□	□	■	□
DB2/z	■	■	□	■	■	□	□	■
Gupta SQLBase	■	■	□	■	■	□	■	□
HP Allbase	□	■	□	□	■	□	□	□
Informix OnLine	□	■	□	■	■	□	■	□
Ingres Server	□	■	□	□	■	□	■	□
Microsoft SQL Server	■	■	□	■	■	■	■	■
NerWare SQL Server	■	□	□	□	□	■	■	■
Oracle7 Server	■	■	□	■	■	■	■	■
OS/2 Extended Services	■	■	□	□	■	■	□	■
Sybase SQL Server	■	■	□	■	■	■	■	■
XDB-Enterprise Server	□	■	□	■	□	■	■	□
Other	None	SQL/400	None	Watcom	SQL/400	Watcom	Unify 2000	None
Native ODBC support	■ (Windows version only)	■	■	■	■	■	■	□
Other middleware APIs supported	DDCS/2, EDA/SQL (Windows version only), MDI	EDA/SQL, MDI	None	DDCS/2	EDA/SQL	None	MDI	DDCS/2
Native non-SQL formats supported:								
ASCII (comma-delimited)	■	■	■	■	■	■	■	□
Btrieve	□	■	■	■	□	□	□	□
DataEase	□	□	□	■	□	□	□	□
Paradox	□	□	□	■	□	□	□	□
Xbase	■ (Windows version only)	■	■	■	□	□	□	□
Client platforms:								
Macintosh	□	□	□	□	□	□	■	□
OS/2	■	□	■	□	□	□	□	■
Unix	□	■	□	□	□	□	■	□
Windows	■	■	■	■	■	■	■	□
Can act as DDE client/server	■ ■	■ □	■ ■	■ ■	■ ■	■ □	■ ■	□ □
Supports OLE 1.0	■	■	□	■	■	■	□	□
BLOB support:								
Images	N/A	■	■	■	■	■	■	N/A
Sound	N/A	■	□	□	■	■	□	N/A
Video	N/A	■	□	□	■	■	□	N/A
Data Sources								
Queues database for table names	■	■	■	■	■	■	■	■
Accesses multiple sources with one query	□	□	■	□	■	■	■	□
Joins tables from multiple sources	■	□	■	□	■	■	■	□
Updates multiple databases simultaneously	■	■	■	□	■	■	■	□
Can create database from front end	■	■	■	■	■	■	□	■
Programming								
Supports graphical joins	■	■	□	■	■	■	□	□
Connects to 3GL modules	■	■	■	■	■	■	■	■
Supports front-end security for:								
Database	□	□	□	□	■	■	■	■

N/A—Not applicable. The product does not have this feature

^① The price is for the Business Object Corporate Edition, which includes Enfin 4.0 with Distributed Presentation and Peer Options, Synchronicity 1.0, and TeamBuilder 1.0^② The price includes PARTS Workbench 2.0, PARTS Workbench Writer 2.0, Smalltalk/V 2.02, Team/V 1.2.1, and PARTS Wrapper for Relational Databases 2.0^③ The price includes VisualAge Team 1.0 and Multi-Database Feature

A red fire hose with a black nozzle is coiled on a green lawn. The hose is the central focus, with its nozzle pointing towards the bottom left. The grass is a mix of green and brown, suggesting a well-maintained but slightly dry lawn. The lighting is bright, casting soft shadows.

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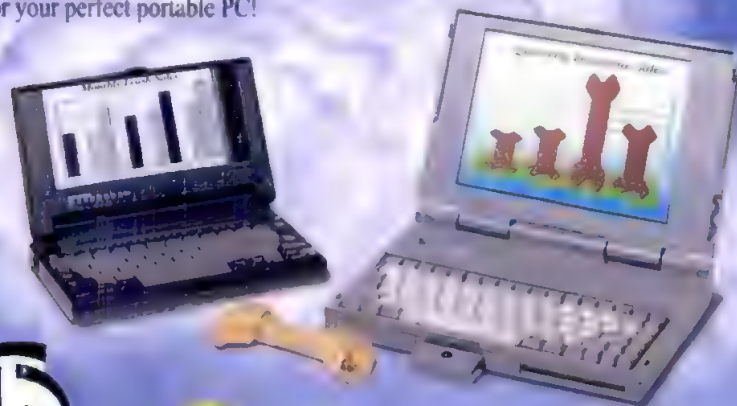
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SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order

■ = YES □ = NO

Programming (continued)

	Object Studio	ObjectView Enterprise 3.01	PARTS	PowerBuilder Enterprise 3.0a	SQLWindows Corporate Edition 5.0	Team Enterprise Developer 1.8	Unify Vision Enterprise 1.1	VisualAge Team for OS/2 1.0
Group	□	□	□	□	■	■	■	□
Table	□	□	□	□	■	■	■	□
File	□	□	□	□	□	■	■	□
User	□	□	□	□	■	■	■	□
Constructs queries/nested queries from menus	■□	■□	■□	■■	■□	■■	■■	■■
User can edit generated SQL code	■	■	■	■	■	■	■	■
Supports scheduled queries	■	□	■	□	■	■	■	□
Provides ready-made templates	■	■	■	■	■	■	■	■
SQL database included for standalone development	Proprietary	SQLBase	None	Watcom	SQLBase	XDB	None	None
Native GUI controls								
Button bars	■	□	■	■	■	■	■	■
Menu bars	■	■	■	■	■	■	■	■
Toolbars	■	□	■	■	■	■	■	□
Programmer can design custom controls	■	□	■	■	■	■	■	■
Programmer can use .VBX custom controls	□	□	□	■	■	□	□	□
Automatic field creation	■	■	■	□	■	■	■	■
Automatic increment-field creation	□	□	□	□	■	■	□	□
Masked fields	■	■	■	■	■	■	■	□
Multiple Document Interface (MDI) support	■ (Windows version only)	■	■	■	■	■	□	□
Object-oriented constructs supported								
Encapsulation	■	□	■	■	■	■	■	■
Polymorphism	■	□	■	■	■	■	□	■
Inheritance	Single	None	Single	Single	Multiple	Single	None	Single
IDE features								
Multiple files and screens supported	■	■	■	■	■	■	■	■
On-the-fly syntax checking	■	□	■	□	■	■	■	■
Context-sensitive help	■	□	■	■	■	■	■	■
4GL help	■	■	■	□	■	■	■	■
On-line SQL syntax help	□	□	□	□	□	□	■	■
Built-in version control	■	■	■	□	■	■	■	■
Hooks to third-party version-control system	■	■	■	■	■	■	■	□
Multiple-programmer support	■	■	■	■	■	■	■	■
Developer security levels	□	■	■	□	■	■	■	■
Debugging								
Programmer can test in development environment	■	■	■	■	■	■	■	■
Interactive debugger	■	■	■	■	■	■	■	■
Breakpoints	■	■	■	■	■	■	■	■
Watchpoints	□	■	■	□	■	■	■	■
Watch variables	■	■	■	■	■	■	■	■
Step-trace execution	■	■	■	■	■	■	■	■
Two-monitor support	□	□	■	□	□	□	□	■
End User Features								
Includes statistical functions	□	□	□	■	■	■	□	□
Supports MAPI/VIM	□□	□□	□□	■□	■■	□□	□□	□□
User can save snapshots of data and views	□	■	■	■	■	■	□	■
Graphics support								
.BMP	■	■	■	■	■	■	■	□
EPS	□	■	□	□	□	■	□	□
.GIF	□	■	□	□	■	■	■	□
PCX	□	■	□	□	■	■	□	□
TIFF	□	■	□	□	■	■	□	□
Separate report writer	□	■	□	□	■	□	■	□
Built-in GUI report writer	■	□	■	■	■	■	□	□
Integrated reporting	■	□	■	■	■	■	■	□
Built-in label/mail-merge support	□□	■□	□□	■□	■□	■■	□□	□□
Integrated chart support	■	■	□	■	■	■	□	□

oriented applications and a mature 4GL scripting language for customizing application behavior. Multiple concurrent access to major SQL databases is provided through a bundled ODBC driver and a broad selection of optional native SQL drivers.

Still, there are some pieces missing from this 1.1 release. The environment doesn't supply a dedicated code editor, query builder, report writer, or charting module. Unify Vision's claims to object orientation also need to be taken with a grain of salt. And important platforms such as OS/2 and System 7 are not yet supported, although System 7 is promised for an upcoming release.

APPLICATION CONSTRUCTION

At the highest level, Unify Vision organizes your applications as Projects. These open to reveal Applications Containers, where you store various forms, tools, and shared libraries making up your application. You begin a new application by using the Application Profile Editor to define data sources, validation rules, and types of database operation your application will do. Then, choosing the Generate Default Application option lets you select tables and fields for generating forms. This automatically builds an Application Container with forms built as specified.

Returning to the Application Profile Editor, you can specify runtime behavior, including the order in which forms are displayed, on-line help files and error messages available to the end user, and the application's icon. Unify Vision's extensive error messages can be customized to provide end users with application-specific messages such as a warning, for example, that a field must contain a value. From here, you can use the Object Designer to customize your application, attaching menus and tool bars to your forms. You can also use the product's SmartView programming capability to define the behavior of each discrete form. SmartView provides menus for specifying allowable database operations (Update or Delete, for example), visual properties, repeating groups, default-find behavior, and other typical form properties.

While most standard Windows interface objects are supported, some, such as spin buttons and combo boxes, have been

■ Due by Year's End: *PowerBuilder 4.0*

By David S. Linthicum

Powersoft Corp. has announced the successor to its enormously successful PowerBuilder Enterprise 3.0a. Due out in the last quarter of this year, PowerBuilder 4.0 looks poised to add important new features, including multiplatform support, C and C++ compiler technology, enhancements to the object-oriented model, and improved report writing and database access.

GOING PORTABLE

PowerBuilder 4.0 will move out of its Microsoft Windows-only rut to become a portable development environment. Support is expected for AIX from IBM, HP/UX, Macintosh System 7, Microsoft Windows NT, OS/2, and Sun Solaris. A recompile step will be necessary to port your source code to new platforms, but conditional scripts will let applications react to differences in each host operating system.

The new release also takes the first step toward incorporating Watcom compiler technology into the product. PowerBuilder 4.0 will include a Watcom C/C++ object class generator that you can use for building DLLs or other routines that demand C/C++ programming. But Version 4.0 will not let you compile your actual application to machine code.

Configuration management looks to be a strong point of Version 4.0. The new release supports multiple-applications management, multiple-release control, and parallel development facilities. The most significant of these features will be applications versioning that lets you set version labels on all PowerBuilder objects. Once the labels exist, you can make changes to the library, knowing you can return to the previous version

with a few mouse clicks. The downside is that this facility will still be based on Intersolv's PVCS version-control facility, which is sold separately.

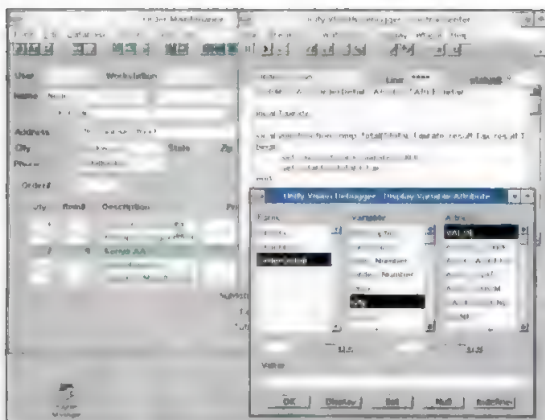
Version 4.0 will introduce slight changes to the way PowerBuilder uses objects. When creating an object class, you will be able to use true nonvisual classes. You will also be able to extend the functionality of existing nonvisual classes and access external object classes, including DLL custom controls.

Support for Microsoft's new OLE 2.0 architecture is included in Version 4.0, as is support for object specifications such as the Object Management Group's (OMG) Common Object Request Broker Architecture (CORBA). PowerBuilder 4.0 will also directly support remote-service toolkits, such as DCE and Tuxedo.

The new release will beef up PowerBuilder's reporting capabilities by adding support for nested reports. Developers will be able to place DataWindows inside other DataWindows, allowing for a header section as well as a report detail, for instance. In addition, you'll be able to mix and match different formats inside the same report.

A new database feature is the data pipeline. This will let you take a data source and put it somewhere else, simply by defining an incoming pipe connection from one data source and sending it to another data target. Powersoft claims the ability to move up to 10,000 rows in under a minute. Finally, 4.0 will at last support Oracle7's stored procedures. All told, this new release looks poised to bring welcome improvements to a classic client/server tool. □

RAD Tools



Unify Vision's debugger provides a full range of capabilities for sleuthing application errors.

left out in the interests of cross-platform consistency. Unify plans to include a more complete set of Windows controls in Version 2.0, due by the end of 1994.

SOME HITS, SOME MISSES

If SmartView doesn't support the specific application behavior you need, Unify Vision provides a full-featured, event-driven 4GL. In testing, we found that we had to extend the product's functionality fairly often by writing 4GL code. If required, you can also call external DLLs or executables from within an application.

Although the language is quite flexible, Unify Vision's claim to support object-oriented development is somewhat overstated. The environment isn't rigorously class-based, and it doesn't support inheritance or polymorphism. Reusability of code is generally accomplished by straightforward copying and renaming of forms, tools, and menus.

Unify Vision lacks a dedicated code editor, so any scripts you write must be created using a third-party editor of your choice. There is also no provision for adding 4GL-syntax checking to an external editor. This is unfortunate since there is no way of catching the inevitable typos until you reach the debugging stage. This fault is somewhat offset by the 4GL debugger itself, which provides a full range of debugging capabilities in an interpreted environment, including syntax checking, breakpoints, watchpoints, and step-through.

Unify Vision doesn't have a query builder, but its built-in query-by-form capability is a powerful and flexible feature

that lets you launch queries from any application form. Query by form allows field matching, wildcard searches, and even Boolean searches on any field in any form. The query results are displayed in the form along with the number of records retrieved. You can scroll through each matching record.

The supplied report writer is little more than a basic text-formatting application that betrays a character-mode Unix pedigree. To create a report, your application executes a SQL

statement and sends the results to a text file on a file server or workstation. The report writer then executes to format the result set and send the formatted text file to a printer. Each of these actions must be embedded in a 4GL script that is called from your application. The results are adequate for only the most basic plain-text reports.

To make up for the lack of adequate reporting capability, Unify currently offers Borland International's ReportSmith 2.0 (\$299), a full-featured Windows reporting package with a query builder and complete formatting and graphics features. (ReportSmith was used to complete the reporting section of our tests.) There is no true integration between Unify Vision and ReportSmith, however, and re-

ports developed in ReportSmith are not portable to Unix platforms. Neither Unify Vision nor ReportSmith includes charting capabilities.

Although Unify Vision supports check-in/check-out, more sophisticated source-code control also requires third-party add-ons. Unify Vision lets you launch third-party tools, including version-controls systems from within the environment using a brief 4GL script. True integrated support for third-party source-code-control systems, such as Intersolv's PVCS, is planned for the next version.

APPLICATION DISTRIBUTION

Finished applications compile to three small pseudo-code files that can be ported unchanged across all supported platforms. These are easily deployed using platform-specific runtime versions of Unify Vision. The per-user cost for the runtime environment is roughly 10 percent of the development environment (\$395 per user for the version we tested).

The supplied documentation is excellent and very complete. The ten cross-referenced volumes probably contain everything you will ever need to know about the product.

Unify Vision delivers an intuitive graphical front-end tool that is best suited for building transaction-based applications. Its cross-platform strengths, backed by strong server connectivity, should prove to be a significant draw for development in mixed Windows/Unix environments. But the lack of such tools as a built-in editor and graphical report writer are substantial drawbacks. If you're developing for only a single platform, you'll probably be better off with another tool.

IBM Corp.

• VisualAge Team for OS/2

BY GABRIELLE GAGNON

IBM Corp.'s VisualAge Team for OS/2, Version 1.0, is an industrial-strength, integrated development environment for building client applications in Smalltalk. Based on the construction-from-parts technology pioneered by Digitalk's PARTS, VisualAge transforms an elegant concept into a powerhouse for corporate development. The basic product ships with over 2,000 classes, and several add-on packages

► FACT FILE

Unify Vision Enterprise, Version 1.1



List price: \$3,995. **Requires:** 386-based PC or better, 6MB RAM, 25MB hard disk space, Microsoft Windows 3.1 or later.

In short: Unify Vision provides a slick cross-platform development tool that will appeal to mixed Unix/Windows environ-

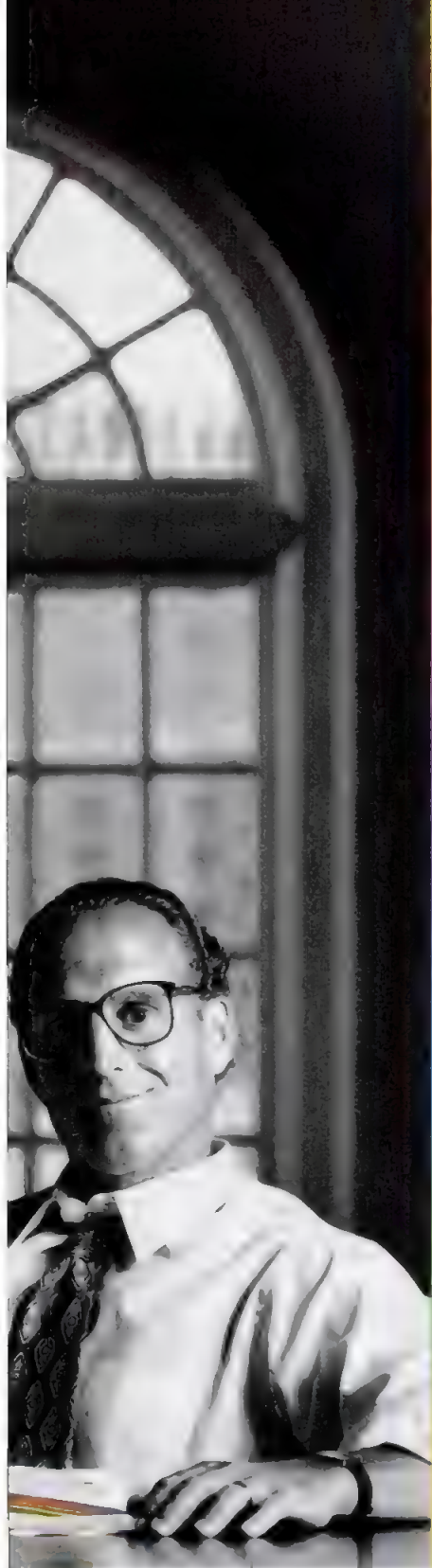
ments. Applications can be ported without recompiling. While its OOP implementation does not run very deep, it provides good graphical tools, event-driven programming, and some reuse capability. Missing pieces—particularly a built-in code editor and graphical report writer—make it less appealing where cross-platform deployment is not an issue.

Unify Corp., 3901 Lennane Dr., Sacramento, CA 95834, 800-864-3948; fax, 916-928-6401

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We reviewed VisualAge Team for OS/2, Version 1.0, the team development version of VisualAge, and VisualAge Multi-Database Feature, the product's SQL-database add-on. VisualAge Team features a centralized repository and includes a full complement of tools for configuration management, versioning, and release control. IBM sees VisualAge as a means of moving its mostly COBOL-oriented mainframe and minicomputer clients to object-oriented, client-server technologies. But VisualAge will also be attractive to developers wanting to upsize PC applications or venturing into their first object-oriented programming.

At this writing, VisualAge 1.0 is available only for OS/2, but a Windows version should be available by press time, with an AIX version for Motif coming later. VisualAge 2.0 for OS/2 is expected in October. Though version 1.0 is remarkably robust for a first release, it is missing elements, such as DDE communications and international character-set support, that developers expect in a full-featured OS/2 development tool. Support for non-IBM relational databases is also spare. Out of the box, VisualAge connects to IBM's DB2/2 and the older OS/2 Database Manager, as well as the DB2, SQL/DS, and SQL/400 mainframe and minicomputer databases via the DDCS/2 gateway. The VisualAge Multi-Database Feature broadens SQL access to include Oracle and SQL Server only. These shortcomings will be rectified with Version 2.0 when IBM adds Open Database Connectivity (ODBC) drivers, DDE client and server parts, and international Double-Byte Character Set (DBCS) support.

SUITABILITY TO TASK

VisualAge Team for OS/2

	Power	Ease of Use
Connectivity	FAIR	GOOD
Professional development	EXCELLENT	GOOD
DSS/reporting	N/A	N/A
Prototyping/quick development	EXCELLENT	GOOD

N/A = Not applicable. The product could not complete this task.

AIMED AT THE PROS

While its visual tools offer a refreshingly simple metaphor for building applications, the VisualAge environment is expressly for professional programmers. When starting VisualAge, the Transcript Window, a control window that displays system messages and runs Smalltalk code, is the first tool you encounter. You enter code directly in the Transcript Window or

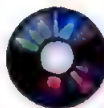
access other VisualAge tools from the Transcript Window menu.

The visual tools include a Composition Editor, a Script Editor, and a Public Interface Editor. These are presented as separate views of the application, and you can switch views by clicking on one of three view icons located in the lower right-hand portion of an Editor window.

Most of the interface design and layout



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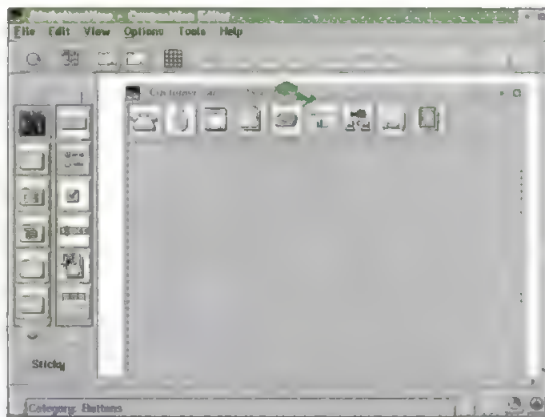
is handled in the Composition Editor. This is where you select and assemble the parts for your application and define the connections between them. Parts are encapsulated objects that are used to build applications. They may be visible (for example, a push button) or non-visible (for example, a query-result set), and they may be combined with other parts and encapsulated to create composite parts.

The VisualAge Composition Editor is very similar to the DigItalk PARTS environment. As in PARTS, you select objects from a palette, place them on the screen, and visually define connections between them. Also as in PARTS, connections are depicted as color-coded, bidirectional arrows representing the type of connection. Four kinds of connections can be defined in VisualAge: Event-to-Action, Attribute-to-Attribute, Event-to-Script, and Attribute-to-Script. And VisualAge goes much further than PARTS in the number of attributes offered and the number of events and actions to which a part may respond. For example, rather than the simple CloseWidget event PARTS offers, VisualAge supplies CloseWidgetRequest, AboutToCloseWidget, CloseWidget, and ClosedWidget events. That may be overkill to some, but developers who have struggled with workarounds because they couldn't trap the right event can appreciate the subtle distinctions.

The Script Editor is used primarily to write Smalltalk code that enhances a part's behavior or overrides its existing methods. Although VisualAge is designed for professional developers, IBM does not assume that VisualAge users are familiar with Smalltalk and provides clear, easy-to-understand documentation for every level of experience. Plentiful online documentation is also provided, including an API reference.

In addition to the visual tools, VisualAge packs a full suite of Smalltalk language tools. These include an Applications Manager, a Debugger, and an assortment of browsers and inspectors. The Applications Manager lets you identify and manage classes that pertain to

particular applications. It can be used to tailor runtime images so that they include only the classes that are necessary to the application. VisualAge can also divide applications into functional units called *subapplications*, which can be further subdivided



The visual tools in VisualAge provide a simple metaphor for constructing applications from Smalltalk parts.

into other *subapplications* for as many levels as are needed. This feature is particularly useful for managing team development projects where large applications may contain thousands of classes. Another nice feature of the team tools is that version control can be implemented for individual parts, not just application modules.

The Applications Manager window is divided into three panes. A list of applications is displayed in the first pane, and related lists of classes and prerequisite

applications appear in the other two. Double-clicking on an application brings up an Application Browser that lets you look at an application's classes and methods in more detail and edit them. In VisualAge, applications are objects in themselves with their own behavior and the ability to send and receive messages to other applications. This allows you to make extensions to applications the same way you do for classes. Other browsing tools include a Class Browser, a Methods Browser, and a Hierarchy Browser. The Hierarchy Browser lets you zoom in on a single class and search its inheritance tree. Various options exist for hiding and displaying items in the browsers, and you can work with multiple instances of each browser for easy reference.

The Smalltalk environment is ideal for interactive testing and debugging, and the VisualAge Debugger offers such professional features as interactive step-tracing, watchpoints, and even the two-monitor support you'd expect in a professional language tool. What's missing, however, are specialized debugging aids for the visual interface—for example, a way to trace through the network of connections between parts. IBM promises that such tools will be forthcoming.

HARDWARE REQUIREMENTS

With so much built-in power, it's not surprising that VisualAge demands enormous hardware resources. We found its performance quite sluggish, even on a 66-MHz 486 DX2-based test system with 32MB of RAM. IBM is working on this problem and expects to improve performance significantly in the product's next release.

The only other drawback to VisualAge is the lack of any report-writing tools. While IBM has some excellent visual reporting products for OS/2, such as Visualizer, these are not Smalltalk-based, nor can they be easily integrated into a VisualAge application.

Despite its present flaws, VisualAge promises to be a major force in corporate applications development. The dream of easily assembling mission-critical applications from reusable objects takes a step toward reality in this intriguing and powerful product. □

► FACT FILE

VisualAge Team for OS/2, Version 1.0



List price: With Multi-Database Feature, \$5,990. **Requires:** 486-based PC or better, 16MB RAM, 35MB hard disk space, OS/2 2.1. **In short:** VisualAge, despite the simplicity of its visual development metaphor, is a powerful tool designed for industrial-

strength jobs. Based on the object-oriented Smalltalk language, VisualAge also provides a full suite of Smalltalk tools. It demands powerful hardware and does not support report development, but it promises to be a serious contender for corporate development. An upcoming version will add Windows support and stronger connectivity.

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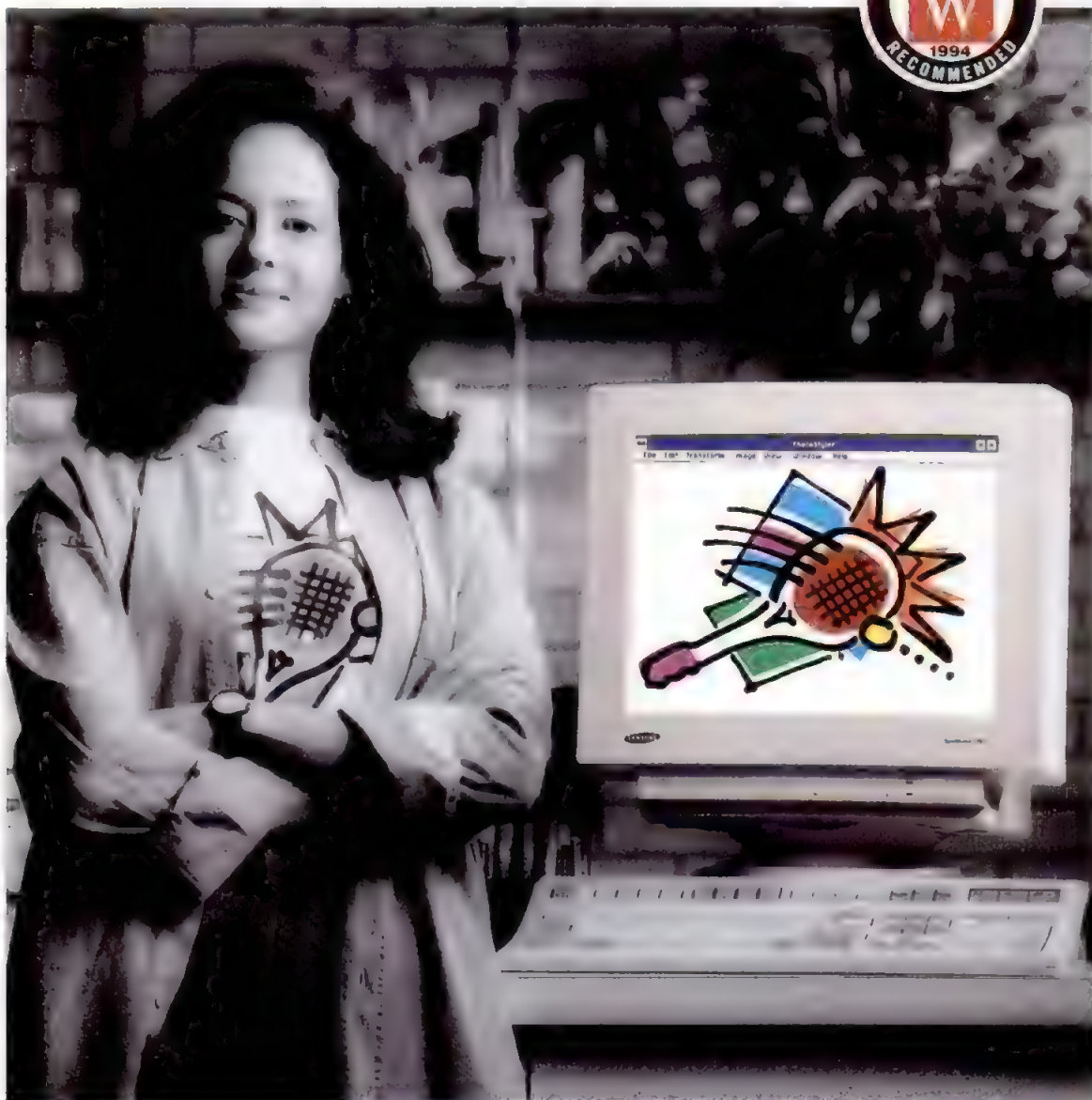
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BUSINESS TOOLS

The Manager's Toolkit



These days, you may not need an MBA to run a business. Software can show you how to plan and forecast business growth—and even manage your employees.

By Lance Ulanoff

Software has freed business managers from some of the tedium of producing budgets and creating documents, but until recently, it did little to help the business manager conduct the actual business of managing. Can software help with critical tasks, such as guiding you through the tricky and painstaking process of creating a business or marketing plan? Can software help you generate accurate financial forecasts? Can it help automate the myriad minutiae of managing, writing performance evaluations, and handling human resource issues?

Sometimes referred to as MBA-ware or management software, these programs address a wide array of business needs. For example, in our sidebar "15 More Management Tools for Conducting Business" we look at packages that help you hire and evaluate employees, manage your business, brainstorm

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new business ideas, and negotiate with the sharks. MBA-ware is a category that's growing so fast it even has its own organization, the Management Software Association (800-622-1441).

BUSINESS PLANNING

The two main evaluations we've undertaken for this story focus on seven business-plan creation packages and three forecasting tools—categories that actually predate the idea of MBA-targeted software.

If you have ever thought about starting your own business with the financial help of outside investors, you can attest to the anxiety one feels when asked to come up with a workable business plan. At the outset, these plans can look like nothing more than glorified presentations. But because of the analysis that goes into them and the financial calculations used to create the charts that accompany the sales pitch, they are truly plans for success. To create a good plan, you must have market analysis, a comprehensive competitor profile, and financial information that represents a real possibility of succeeding in the marketplace.

BUSINESS FORECASTING

Forecasting software is most often used on the other side of the fence, *after* a business has been started. Chief financial officers (CFOs) regularly use it to plan out the fiscal year, relying on the software's calculation abilities to help them make a very educated guess about where their company will be at the end of that year. Accounting departments in large organizations as well as entrepreneurs in three-person offices can use forecasting software to decide which capital projects to undertake and which financial risks may prove too dangerous.

What's most interesting about all these programs is that all of them, to a certain degree, rely on faith: faith in the numbers you input into your forecasting software, and faith that the business you propose can really perform as described in your business plan. And that's funny, because faith is probably the one thing that neither software nor business school can teach you.



Forecasting:

• Forecast Pro for Windows

Business plan creation:

• None yet

The Editors' Choice for forecasting software goes to Business Forecast Systems' Forecast Pro for Windows, Version 2.0, and, in particular, to its Ex-

tended Edition (XE). While Forecast Pro's output options could use some work, the package remains strong in helping you figure out which model to choose and what steps to take to complete a forecast.

Outdated interfaces hampered the two other forecasting programs. Smart Software's SmartForecasts does have some features in its standard edition that Forecast Pro lacks, notably the ability to forecast multiple time series simultaneously. Nonetheless, SmartForecasts still suffers from its throwback interface. Alphametrics Corp.'s Modler MBA Business Analysis Program, with its PowerStation add-on, is a remarkable program in terms of its functionality, but it, too, has an anti-

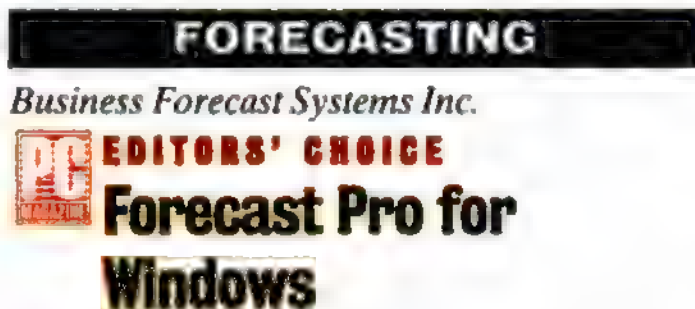
quoted interface.

In business-plan creation, we found that many of the products, such as JIAN Tools for Sales' BizPlanBuilder, rely heavily on the innate abilities of other applications to do the text formatting and number crunching necessary to produce an effective business plan. Certainly, all of these products should be able to exchange data with your spreadsheet and word processing applications, but the heavy-duty financial analysis, layout and page creation, and automated guidance should reside in the business-plan software.

Business Resource Software's Business Insight offers some of the most extensive financial and business-plan guidance we've seen, but doesn't follow

simple moving averages, exponential smoothing (including Winters), and Box-Jenkins models, fits best. You can also develop dynamic regression models, which may be recommended by the expert mode when a particular time series appears to depend on other variables.

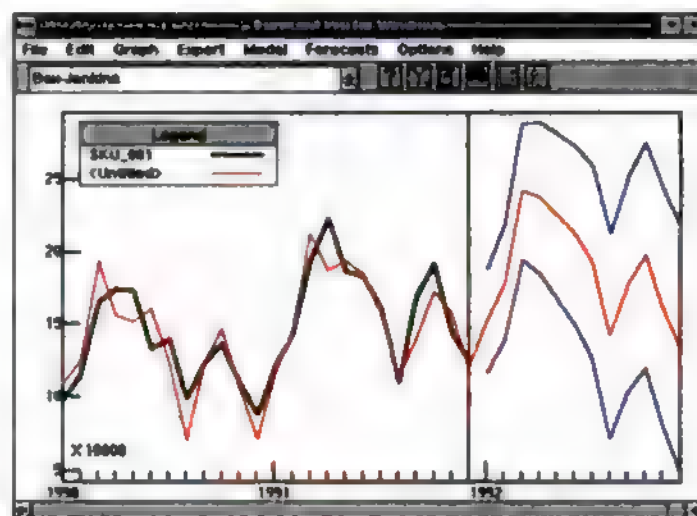
Forecast Pro can read data files in ASCII format, as well as Lotus and Excel spreadsheet formats; you can also estab-



REVIEWS BY THERESA W. CAREY

Business Forecast Systems' Forecast Pro for Windows 2.0 (standard edition, \$595) is a leader in the business forecasting market, and it's easy to see why. Forecast Pro is a winner in almost every way. With a variety of improvements over Version 1.0, the second Windows version is prepared to act as your crystal ball.

Forecast Pro's expert modeling mode, represented by a brain icon on the toolbar, is so easy to use that you might find yourself relying on it a bit too much to specify the appropriate models. The expert mode evaluates each data series automatically to see which method, among



Forecast Pro displays forecasted values along with the confidence limit. The "Untitled" line shows how the model fits historical data.

up this guidance with a clear pathway for transporting that data into a formalized business plan. Palo Alto Software's Business Plan Toolkit has some strong DOS-based guidance, as well as spreadsheet templates, but once again the final plan must be formatted elsewhere. Planet Corp.'s Destiny Business Information and Planning System also has some attractive pieces, including its own spreadsheet and insightful plan advice, but with its spare ASCII word processor and average output options, it's equally short of the full puzzle.

Only two programs, SoftKey International's PFS:Business Plan and Business Resource Software's Plan Write, supply all the built-in tools you'll need to create a plan. The bad news is that the best one, PFS:Business Plan (which includes a word processor, chart editor, and spreadsheet, as well as models and templates), has a cloudy future. SoftKey says that it will continue to sell and support the product, but the company has no plans for upgrades. So for now, we suggest you wait for upgrades of the other packages before you put your money down.

lish DDE links to other applications. The manual has a clear explanation of the pros and cons of each format, since there are some strict rules you must follow to prepare the data correctly. The program does not currently support .WK3 or .WK4 file formats, however, and the standard edition can handle only 50 variables at a time in batch mode. You can add a new variable manually, and you're coached through the process by screen prompts.

After reading in the raw data, Forecast Pro has you define each variable. You use the Data window to build a list of the items you want the program to recognize; this is called a Data Tableau in Forecast Pro parlance. Once a Data Tableau is established, producing a forecast can be as easy as double-clicking on three boxes.

First, each data series must be read and evaluated, then placed in the forecasting processor. As the process is taking place, a breakdown of the variable's history and the recommended forecasting model are displayed in the Audit Trail. You click another icon to calculate and display the forecasts, either accepting the program's recommendation or selecting another model from the drop-down menu.

When a forecast is calculated, you can display it in a graph and then use the Peek and Poke option to alter the results according to your own judgment. Forecast Pro displays the historical data, the calculated model as it compares with actual history, and the forecast with a confidence range. You can specify the confidence level and the number of periods to forecast. The forecasted values can then be saved in the file format you selected for the input file.

Forecast Pro continues to be weak in terms of output. All your work for a session is stored in an Audit Trail, which is a handy way to keep track of the work you've done. The only way to prepare a report, however, is to dump portions of the Audit Trail (as ASCII text) into a word processor (the program defaults to Windows Notepad, though you can change that) and do your own formatting. You can save graphs to the Clipboard for transfer to a graphics package, but that's a little clunky, too. Forecasted values are shown as an "Untitled" graph, and the only way to change the label is to name and save your entire forecast. The graph's label then takes on the name of your forecast session.

Forecast Pro XE (extended edition) has several additional models, including promotional and Census X-11. For multiple-level exponential smoothing, it adds up the different values in a hierarchy, maintaining separate forecasts at each level. It also allows up to 100 time series to be forecasted simultaneously in batch mode.

► **Forecast Pro for Windows 2.0.** List price: *Standard edition*, \$595; *extended edition*, \$995. Business Forecast Systems Inc., 68 Leonard St., Belmont, MA 02178; 617-484-5050; fax, 617-484-9219.

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Alphametrics Corp.

• Modler MBA Business Analysis Program

Alphametrics Corp.'s \$1,250 Modler MBA Business Analysis Program, together with Powerstation, its interface add-on, is for the serious modeling expert. It doesn't have the hand-holding of other packages or anything that could compare with Forecast Pro for Windows' expert modeling mode, but if your company has tons of data that need some heavy-duty massaging by people with high-level statistical training, this is a program to consider. Designed for econometric analysis and forecasting, it can handle numerous types of models, including simultaneous systems of equations and input/output structures.

Modler runs under DOS and is command-line-driven; the company plans to release a Windows version in 1995. For now, you can purchase the Powerstation add-on, which has drop-down menus and a slightly friendlier interface, but it still does not make Modler as easy to use as the other products we reviewed.

The installation process could use quite a bit of improvement. We had to do a fair amount of typing at the DOS prompt, creating and changing directories. Options available during installation are displayed after Modler checks your system; a press of the Return key selects an individual option. However, when you choose an option that's not on the main installation disk, the package does not tell you what disk is required.

Alphametrics offers an add-on, Powerstation, which you can use to create a custom front-end to meet your specific modeling and data-entry needs. (Alphametrics will also review your data and design a custom front-end for you). The Powerstation interface lets you launch word processors, spreadsheets, and communications programs, or simply shell out to the DOS prompt. It still lets you stay in Modler but access your other DOS applications.

Modler lets you write macros to customize your work; you can, for example, have the package bring in a data file automatically and perform operations on it. Editable sample macros are provided so you can see how they work.

Our Contributors: KATHLEEN CASTER is a staff editor at *PC Magazine*.

THERESA W. CAREY and KATHY YAKAL are frequent contributors to *PC Magazine*.

LANCE ULANOFF was the associate editor in charge of this story, and JEFF MACE was the project leader.



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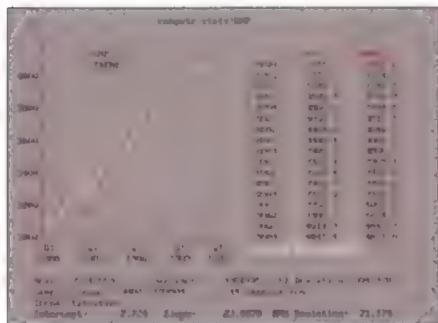
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Modler stores your data—up to 150,000 time series—in Data Banks, which have annotated indexes that keep track of each series name, its description, units of measure, data sources, frequency, and periods covered. The indexes also state the last time the series was changed. These Data Banks are fully indexed and



Modler MBA Business Analysis Program can analyze time-series information and provide descriptive statistics and graphics.

searchable via the Find command. In fact, when Powerstation is loaded, you can open and search two Data Banks simultaneously; without Powerstation you can have up to 15 Data Banks open.

Selecting a variable can be tedious if you don't know its exact label. You have

to browse the Data Bank, or at least remember the first few letters of a series name in order to bring it into the analysis area of the program. Powerstation, though, does have a Find key, F10, which performs word-based searches through the Data Banks. You can view data on-screen and modify graphics easily by pressing the Slash key to access drop-down menus. Modler supports a variety of plotters as well as the standard printers, so you can produce very high-resolution output directly from the program.

Modler can quickly transform data from one period type (such as monthly) to another (quarterly) and can also display such functions as percentage changes, unit differences, and logarithms without having to create another variable.

If you need to build regression models to produce forecasts, Modler is the obvious choice. You select the item you want to forecast and then see how other data series in your bank affect that particular item. This feature helps you select the independent variables that should be included in your forecasting model. Modler lets you develop an Assumptions file that the forecast uses in its calculations; you can change these assumptions to do "what if" analysis.

File protection in Modler can help you recover from anything short of a total system crash. Some of the package's work is done in RAM, which is saved to a crash file in case of disaster. You can recover all or most of your work by loading that file when you get back into the program.

Modler was designed to make data accessible in many different forms. A knowledgeable user can make the program fly, but it's not for the faint of heart. **► Modler MBA Business Analysis Program.** List price: \$1,250; with Powerstation, \$1,500. Contact Alphametrics Corp. for information on network license fees and customized Powerstation interfaces. Alphametrics Corp., P.O. Box 2566, Bala Cynwyd, PA 19004; 610-664-6480; fax, 610-667-8390.

Circle 468 on reader service card

Smart Software Inc.

• SmartForecasts

Although SmartForecasts 3.1 (standard edition, \$595), from Smart Software, packs a lot of forecasting and modeling power, its DOS interface is still painfully behind the times, so it's not the best choice for a novice forecaster.

This upgrade, however, does have many improvements, including better graphics resolution, support for more spreadsheet formats for data import and export, and a PROMO feature that allows the user to model the effects of irregular events such as extreme weather conditions or a new advertising campaign.

Installation is easy—a matter of verifying your computer setup and picking a printer. The package lets you import data from most spreadsheet formats (any version of Lotus 1-2-3 or Excel, including multisheet models) as well as from ASCII and .DIF files. But because you can read only one file at a time into the program, if you want to combine variables stored in different files you have to do it outside SmartForecasts and then read in the completed file. You enter data directly into the program's worksheet, though specifying the labels and titles gets tedious. You create new variables from existing ones by using the various arithmetic and time-series functions.

SmartForecasts doesn't offer mouse support, so there's no pointing and click-

The Language of Forecasting

Box-Jenkins A group of statistical models that work fairly well on relatively nonvolatile data. It helps to have quite a bit of historical data to develop a good Box-Jenkins model. These models are based on auto-regressive integrated moving average (ARIMA) calculations.

Census X-11 A procedure used by the U.S. government to deseasonalize the most commonly used macroeconomic indices. It separates out the trend, seasonal, and trading day factors and identifies the irregular components of a data series. An advantage of Census X-11 over other trend decomposition models is that it corrects for outlying data. Census X-11 seasonal adjustment is much more complex than exponential smoothing.

exponential smoothing A forecasting method that involves identifying the trend and seasonal factors in a time series and projecting them into the future. A widely used technique, this also

works on short data series.

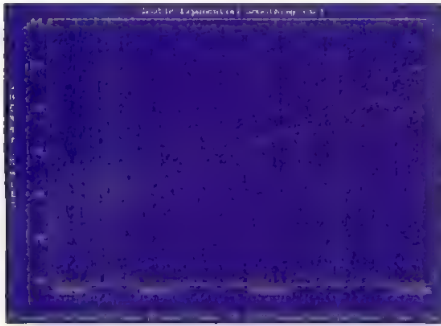
historical data The data on which a forecasting model is based.

moving average A method of smoothing a data series by replacing each data point with an average of several data points.

periodicity The time value for each data point: for example, daily, monthly, quarterly, or yearly.

regression Statistical methods that define one variable—the "dependent" variable—as a function of one or more other variables—the "independent" variables.

univariate Dealing with a single variable or time series. In the context of a modeling technique, *univariate* implies that a variable's forecast depends only on its own past performance. Univariate models include Box-Jenkins.



After running the automatic forecast function in SmartForecasts, you can check out the results graphically.

ing when you want to select items to forecast. The standard edition, reviewed here, forecasts up to 60 items at once, while the far more expensive 32-bit Batch edition can handle 1,200 at a time. Selecting items to forecast involves typing the variable numbers or names at a menu prompt. You can specify one of the five univariate time-series forecasting methods to use—single exponential smoothing, simple moving average, double exponential smoothing, linear moving average, or Winter's exponential smoothing—or let the program's automatic forecasting feature select the best one and calculate the weights that produce the best fit for your historical data. SmartForecasts lets you view the recommended forecast in a line graph; you can also look at the results of this forecasting "tournament" in tabular form.

TOTALLING UP

In addition to the univariate techniques, SmartForecasts lets you forecast up to 60 time series—such as components of a department's sales—together. Selecting the Top-Down forecast under the Multi-series function forces various products to add up to, for example, a brand total. You can also forecast individual product lines and then produce a total for the brand by selecting a Bottom-Up forecast. The program also includes Box-Jenkins (ARIMA) modeling, which helps identify, estimate, diagnose, and forecast time-series data. It also has multivariate regression-analysis capability.

SmartForecasts produces graphs that show the historical data, forecasts, and the fit of the forecasting model to the historical data. To keep the forecasted data on hand, you store it in a new data series. At

this point, you can go into Eyeball mode to adjust the forecast according to nonstatistical judgments such as business knowledge and new market information. Any table or graph can be quickly sent to a printer or saved as a file. Graphs store as .PCX files for further customization; tables save as ASCII text.

Though its statistical engine is finely tuned, SmartForecasts is ultimately hobbled by its antiquated interface. Smart Software is planning to release a Windows version of the program in the spring of 1995, which should address the interface problem. The new version will have a report generator as well.

► **SmartForecasts 3.1.** List price: *Standard edition*, \$595; *concurrent network edition (for 2 users)*, \$995; *Batch/500 edition*, \$4,995; *32-bit Batch edition*, \$9,995. Smart Software Inc., 4 Hill Rd., Belmont, MA 02178; 617-489-2743, 800-762-7899; fax, 617-489-2748.

Circle 469 on reader service card

BUSINESS PLAN CREATION

JIAN Tools for Sales Inc.

• BizPlanBuilder

REVIEWS BY KATHY YAKAL

Unlike other products reviewed here, JIAN's \$129 BizPlanBuilder isn't a stand-alone application. Instead, it's simply a collection of business plan template files stored in formats designed to work with your existing word processor and spreadsheet. While this makes for the best possible presentation-quality documents, it also means you'll have to carefully comb your finished business plans for leftover boilerplate text and data—and that you'll receive little automated help along the way.

BizPlanBuilder includes a set of 33 word processing and spreadsheet files, models, and templates for building a business plan. Once you've installed the program in its own directory, you can open the files in your own word processor or

spreadsheet.

The included stock business plan uses an outline that starts with your present situation and works its way through objectives, management, product and service descriptions, market analysis and strategy, manufacturing concerns, and financial projections. This is followed by a section where you create an Executive Summary and Conclusion.

The outline walks you through each topic and subtopic with several kinds of guidance. First, a short sentence, such as "Describe briefly how you will make sales happen," explains what information is needed in each topic and subtopic. Second, boilerplate paragraphs serve as a model that you can edit to fit your situation. Where appropriate, the package suggests actions you can take to help you answer questions you couldn't answer during the outline process.

SIMPLE STATEMENTS

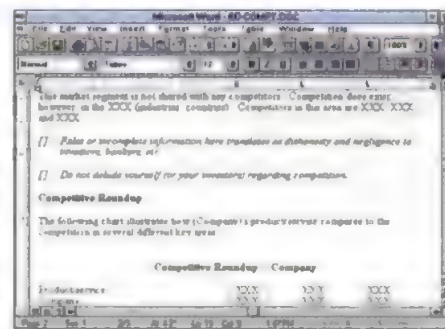
If you don't have a spreadsheet, you can still prepare bare-bones financial statements. BizPlanBuilder gives you sample forms that report start-up costs, use of funding proceeds, cash flow forecasts, and a break-even analysis.

You can crunch numbers in a more sophisticated format using the program's financial projection templates with your spreadsheet. You can either replace the

program's fictitious figures with your own to produce Budget, Cash Flow Statement, Income Statement, Balance Sheet, and Break-Even Analysis spreadsheets, or combine your financials in the Integrated Financials spreadsheet. The latter is better because it takes less time to prepare and

there are fewer chances to make transposition errors.

While BizPlanBuilder's design cuts down on your learning time, it can create problems if you don't keep track of precisely which documents are and aren't finished. And if you want each section to move smoothly into the next,



BizPlanBuilder uses a combination of charts, tips, questions, and fill-in-the-blank phrases in its outline models.



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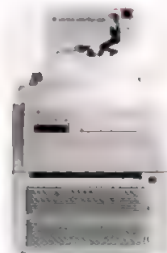
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**TEXAS
INSTRUMENTS**

15 More Management Tools for Conducting Business

By Kathleen Caster

No matter what your managerial responsibilities are, chances are there's a program ready to help you. Here's a summary of 15 tools to help you hire, review, and manage employees; negotiate effectively; sharpen your decision-making skills; and become more creative.

HIRING

• **With HireRight, Version 1.1** (\$149.99), from Rupp Technology Corp. (602-224-9922), you evaluate job candidates' attitudes through a survey and apply an analysis program to the feedback. You can review current employees, but this section is cursory at best. The Windows interface is inconsistent, little on-line advice is given, and the candidate-review section is spare.

REVIEWING

• **With Employee Appraiser, Version 2.0** (\$129), from Austin-Hayne Corp. (415-610-6800), you evaluate employees according to factors arranged in topics. As you work, you view the evaluation text; with the click of an icon, you can make the language more positive or negative. Coach explains how a manager and employee can solve a problem, and Language Scan flags questionable words. You can customize and save evaluations as templates. Note fields and full-featured text editing help round out this Windows program.

• **The Windows-based Performance Now!, Version 1.01** (\$169), from

KnowledgePoint (707-762-0333), takes a similar approach; you select categories and rate employees according to factors. You can choose from sample reviews—such as Clerical—that you are able to alter and save. The package flags you if the ratings are very high or low—or a combination of the two—and suggests that you qualify your ratings. The Advice button calls up details on such things as legal matters and employee communications. The pack-

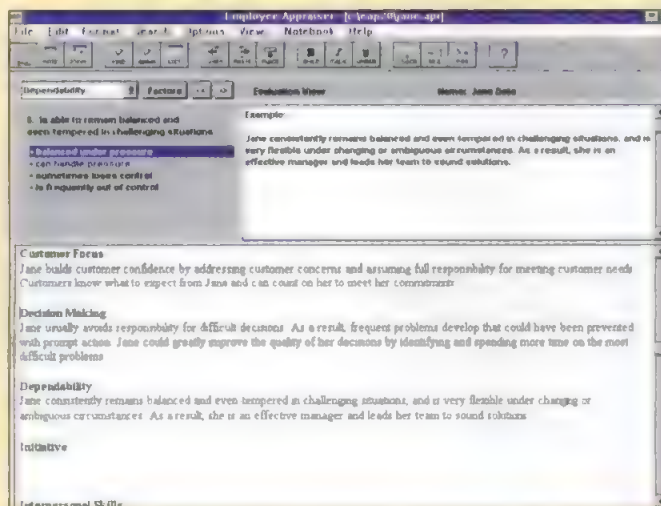
of the company's ManagePro software, keep a log of employee-performance data, and define goals and rate the employee for each goal.

MANAGING

• **WorkWise Employee File, Version 1.1**, from Paradigm Software Development (206-728-2281), helps you manage employee and corporate information. You supplement employee data—which includes employee status, emer-

gency contacts, benefits, and certifications—with your own fields, employee pictures, and notes. Corporate data includes organization charts, benefits, days-off policies, and memos. You can also organize data using Microsoft Access and Crystal Computer Services' Crystal Reports. The Small Business version lists for \$129, and the networkable Professional Version sells for \$279. Version 2.0 is due soon.

• **ManagePro 2.1 for Windows** (\$395), from Avontos Performance Systems (510-654-4600), offers a database centered around goals, people, and actions. You keep a



Employee Appraiser takes a writing-by-example approach. You can simultaneously view categories and their related factors, along with the resulting sample text and the actual evaluation.

age includes a language-checker, an employee-information database, a review calendar, and a tutorial.

• **Avontos Review Writer 1.0 for Windows** (\$129), from Avontos Performance Systems (510-654-4600), provides templates and performance ratings in addition to the usual criteria-and-factors approach to reviews. The package provides QuickBuild Mode and a language- and spell-checker, and it will flag you on sections you missed. You can import data from Version 2.1

Goal Planner, Time Line, People/Team Planner, To-Do List, and Global Calendar. You can attach and launch documents, send e-mail, add notes, sort and filter items, and add fields of your own. All data is linked, and you can share parts or all of the database with others on your network. A five-user license is \$1,725; a ten-user license is \$2,995.

• **With the DOS-based Ronstadt's Financials, Version 3.0** (\$139), from Lord Publishing Inc. (714-240-7090), you build financial projections using

best-case and worst-case scenarios while referring to such financials as income statements and balance sheets. You can group scenarios and conduct variance analysis and consolidation on these groups. You can take notes on fields, record and save macros, create line charts, and refer to a thorough glossary of financial terms.

NEGOTIATING

• **With Negotiator Pro 3.05 for Windows** (\$345), from Negotiator Pro Co. (800-448-3308), you build personal- and negotiating-style profiles for yourself and the person with whom you'll be negotiating. As you answer the questions on the negotiating plan, the package advises you on how best to deal with the other person as dictated by the profiles. The package comes with premade negotiation plans covering matters like increasing job responsibilities.

• **The Art of Negotiating, Version 2.10** (\$195), from Experience in Software (800-678-7008, 510-644-0694), is a straightforward DOS package that steps you through questions on your objectives, issues, positions, needs, gambits, strategies, and agendas. In the process, it asks if any conflicts exist between your strategies and those of the person with whom you're negotiating. Some advice and cues are provided, but you're left to do most of your own thinking.

BRAINSTORMING AND DECISION SUPPORT

• **Decision Pad, Version 2.0** (\$395), from Apian Software (800-237-4565, 415-694-2900), helps you weigh your decisions. If you're pricing PCs for your company, for example, you put criteria (such as disk size) in columns and alternatives (such as vendors) in rows. You define your rating method for each element (disk size, for example, would be based on "high number = best") and input the data for each criterion. The package will automatically enter a

weight for each item and figure out which alternative wins. Decision Pad includes examples and an on-line tutorial, and it supports notes as well as sorting and charting. Networked users can open up a third dimension by voting on alternatives.

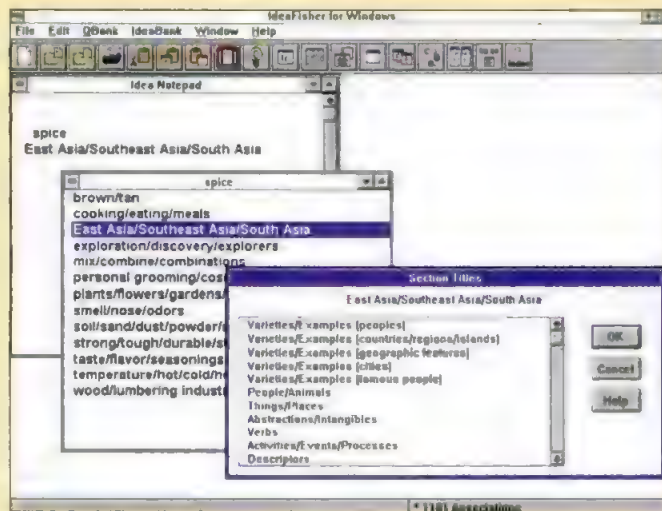
• **With Expert Choice, Version 8.0**, from Expert Choice Inc. (412-682-3844), you find the same criteria-and-

or an advertising concept.

• **Inspiration for Windows, Version 4.0**, from Inspiration Software (503-245-9011), lets you brainstorm by way of flowcharts, tree charts, idea maps, and outlines. The package provides many symbols, shapes, and line types; you can arrange, align, and link diagram elements. The Idea Book offers chart ideas. The provision for free-form diagram-

ming differentiates this package from dedicated diagramming packages, which are typically more rigid. The introductory price is \$129 (through December 31). After that, the price will be \$195.

• **MindLink Problem Solver, Version 2.2** (\$299), from MindLink (802-457-2025), encourages independent thinking while offering random items—poems and pictures, for example—to get ideas flowing. The package asks you to pick up a magazine and focus on, say, the articles; you write down associated ideas. A cross-breeding feature lists two



When you drill down on an item in IdeaFisher's main database, you get many related topics and terms, which can greatly help your brainstorming efforts. The database covers an encyclopedic range of subjects.

alternative method used in Decision Pad, but the package uses a hierarchical diagram of elements. You step through comparisons of alternatives and criteria, and the package provides a ratio that reflects your consistency. The single-user version lists for \$495; the network version (five users) is \$1,495 and \$199 per additional user.

• Your creativity can be boundless if you use **IdeaFisher for Windows** (\$199), from IdeaFisher Systems (800-289-4332, 714-474-8111), and its 800,000-item database of words and phrases. Type in a word and the package will present even loosely related categories. From these you request a type of term—a verb, a place, or an abstraction, for example—and you see related words and phrases. One section, OBank, offers questions to guide your brainstorming sessions as you try to come up with ideas for a product name

things, such as Attila the Hun and a stone, and asks you to write about the combination. At every step you're asked to think about how the images relate to your problem or project. Version 3.0 is due soon.

• **The Idea Generator Plus, Version 3.11** (\$195), from Experience in Software (800-678-7008, 510-644-0694), is a DOS package with a linear question-and-answer approach to problem solving. It leads you through Problem Statement, Idea Generation, and Evaluation sections, asking you to think your way through your problem. You're asked to describe a situation similar to the one you're facing, come up with metaphors to describe it, reverse your goals and approach them from that angle in order to figure out what to avoid, and think about the people involved and what they would suggest about your situation. □

SOFTWARE
Business Tools

you'll have to tweak your text files so that each topic immediately follows the preceding one. If you want to drop charts in with text, though, *BizPlanBuilder* suggests appropriate places. The package's manual offers a helpful reference guide that spells out business-plan concepts in detail.

A new version of *BizPlanBuilder*, 5.0, should be available by the time you read this. It's expected to include over 90 pages of text in the templates, an expanded user manual, and a new Getting Started guide. The package's financials will also be enhanced, including a new Personal Financial Statement template for business owners and more calculating flexibility in the existing spreadsheets.

By offering a collection of template files that can be used in your own favorite programs, *BizPlanBuilder* is the least intrusive business plan product we looked at. The lack of any automation, macros, or business plan-specific tools, though, also makes it less helpful than its competitors.

► **BizPlanBuilder, Version 4.0.** List price: \$129. JIAN Tools for Sales Inc., 1975 El Camino Real, Mountain View, CA 94040; 800-346-5426, 415-254-5600; fax, 415-254-5642.

Circle 470 on reader service card

Business Resource Software Inc.

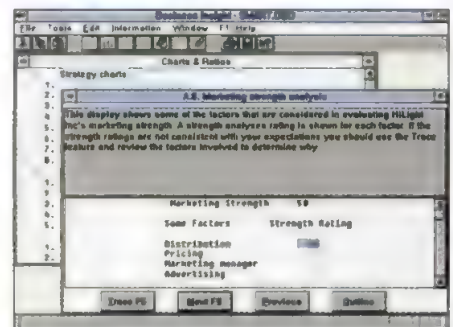
● **Business Insight**

While the term "expert system" is bandied about without much real consideration of how complex a true expert system must be, Business Resource Software's *Business Insight*, \$495, comes closer to it than many packages. It takes a question-and-answer approach to data entry, analyzes your proposed business scenario, and spits out numerous pages of conclusions, observations, and suggestions in the form of text, charts, and graphs. When you've tweaked your financial blueprint to your satisfaction, you can use the insights to prepare a formal business plan.

Business Insight comes in two flavors, one suited for product-based businesses

and one for service-based businesses. Both share a common data-analysis core and work similarly, but the individual knowledge bases tailor each version appropriately.

The first and most grueling element of *Business Insight* requires input regarding your business. Nearly 500 questions in the voluminous Data Input outline grill you for details on business aspects such as your staff, service, or product; the market environment; competition; and financials. Some are yes/no queries, some ask you to select a ranking on a scale, and others let



Business Insight gives you in-depth critiques of multiple aspects of your business strategy.

Model 1465DL 14" auto-scan
9B-264 VAC, non-glare

Model 1520 15" PST auto-scan
MPR II, 9B-264 VAC, digital controls



SOFTWARE
Business Tools

you choose from a set of descriptive phrases. You can attach notes and, where applicable, worksheets to outline items and factors.

Some might find Business Insight's question-and-answer approach tedious and time-consuming. But by insisting on quantifiable responses, Business Insight forces you to scrutinize every element of your business plan. The result, if you're conscientious, is a more honest, in-depth compilation, leading to a more objective and measurable business plan. This makes it easier to evaluate how well your proposed business will perform.

CAREFUL ANALYSIS

Business Insight has several types of analyses. You can create and compare "what if" scenarios and generate a report that analyzes the validity of each. The Highlights and Lowlights sections outline your business's strengths and weaknesses. The Observations wrap-up points out inconsistencies in your business strategy or spots questionable answers and lets you jump back to the data

entries that triggered them. Charts & Ratios spells out the numbers, ranging from basic reports like Income Statement and Projected Return on Investment to more drilled-down calculations like Revenue per Employee and Salesperson.

Real-life business consultants might soften some of their recommendations, but Business Insight's Summary can be painfully direct. "Fire your marketing manager," it might say. "Drop the price of that product" was the gist of a suggestion Business Resources got when it used Business Insight to test its own business plan for the product.

Business Insight suffers some from unclear phrasing in many places; it might have more appeal to the neophyte entrepreneur by simplifying its language and offering more context-sensitive help. Screen fonts are blocky and sometimes hard to read; some sharpening of the interface would be welcome.

While no other product reviewed here offers Business Insight's studied feedback and recommendations, the program still

lacks the formalized framework and tools to prepare a presentation-quality business plan. Its \$495 price tag is higher than other business-plan programs, but Business Insight's depth gives it longevity. You can use it to reexamine your entire business plan at intervals or fire it up when you want to reconsider just one aspect of your business, like pricing or distribution.

► **Business Insight, Version 3.0.** List price: *Product- or service-based version, \$495; additional copy of either version, \$195.* Business Resource Software Inc., 2013 Wells Branch Pkwy., #305, Austin, TX 78728; 800-423-1228; 512-251-7541; fax, 512-251-4401.

Circle 471 on reader service card

Palo Alto Software Inc.

● **Business Plan Toolkit**

One in a series of business toolkits from Palo Alto Software, Business Plan Toolkit, Version 4.1 (\$149.95), consists of a combination of the approaches typically taken by business-plan programs. Busi-

Environmental Engineering

It's an important part of the thinking that goes into the newly redesigned line of monitors from Goldstar. Each one built to be sensitive to the ecology and uncompromising on performance.

Goldstar makes monitors that meet MPR II and VLMF standards for low emissions and reduced electromagnetic fields. And they surpass EPA Energy Star and VESA DPMS criteria for reduced power consumption.

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GoldStar
MONITORS

All The Qualities You're Looking For

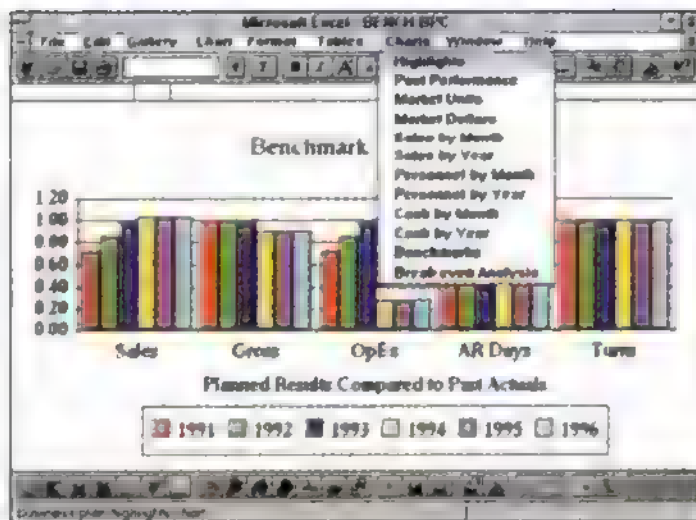
Model 1725 - 17" PST, auto-scan,
MPR II, 90-254 VAC, digital controls



Goldstar U.S.A., Inc. 1000 Sylvan Avenue, Englewood Cliffs, NJ 07632

CIRCLE 371 ON READER SERVICE CARD





Business Plan Toolkit can generate 12 charts and 14 tables in addition to text and spreadsheets.

Business Plan offers a step-by-step, outline-driven, DOS-based text processor whose final output must be sent to a Windows- or DOS-based word processor to prepare presentation-quality printouts.

In contrast, Business Plan's financial projections are prepared using Windows- and DOS-based templates and a chart generator in state-of-the-art spreadsheets. The business-plan model is as detailed as those found in some other products, though you'll frequently have to refer to the documentation.

Business Plan Toolkit comprises two modules. One of them, a DOS-based ASCII text editor called Text Writer, contains an outline of 49 suggested topics. It is divided into sections that cover goals and objectives, the company and its products and people, the market and competition, strategy and implementation, and financials. You can work your way through the outline, reading the brief topic summaries and writing paragraphs that describe your company's specifics. Minimal guidance is available on-screen; you're often directed to refer to a section in the manual. The package also provides a sample plan (both electronically and in the manual).

ON THE MONEY

You prepare financials using the spreadsheet module, which contains spreadsheet files and macros and works with both DOS and Windows spreadsheets. As thorough and proficient as the text module, the spreadsheet module contains templates that can be dropped into Lotus 1-2-3 (.WK1 and .WK3 formats), Microsoft Excel, Microsoft Works, Quattro Pro, and compatibles.

The template files in the spreadsheet module work differently with each application, but an appendix in the manual explains their operation. In Excel 4.0, for example, you open the START.XLM file to work with the primary spreadsheet, which has subsections such as Balance Sheet, Break-Even Analysis, Cash Flow, and Financial Ratios.

The package can automatically generate 12 charts from your data, such as Sales By Month, Benchmarks, and Break-Even Analysis. You can build 14 tables, including General Assumptions, Sales Forecast, and Ratio Analysis. Additional spreadsheets help you build Market Forecast, Product Comparison, Facilities, and Product Sourcing models. You can also toggle between Excel's menus and Business Plan Toolkit's menus with decided ease.

It can be irritating to keep switching between the DOS text editor and a Windows spreadsheet for the same project, so it might be a good idea to follow Business Plan Toolkit's documentation advice and set up icons in the Program Manager to pop you quickly into each application. You can launch into your spreadsheet with the package's main spreadsheet template and menus loaded, but this doesn't help much when it is time to print your final business plan. Palo Alto Software recommends that you print your tables and charts as appendices, though other programs offer more complete integration.

Business Plan Pro (\$149.95), a new program from Palo Alto scheduled for release this fall, will provide a more integrated solution. A new Windows interface will tie together a new built-in word processor and spreadsheet.

Business Plan Toolkit encourages clarity and thoroughness while discouraging overkill. Its use of a DOS text editor for document preparation may not appeal to some, and its lack of integration and on-line guidance is troublesome, but the tools it offers for preparing a creditable business plan are sound.

► **Business Plan Toolkit, Version 4.1.** List price: \$149.95. Palo Alto Software Inc., 144 E. 14th Ave., Eugene, OR 97401; 800-229-7526, 503-683-6162; fax, 503-683-6250.

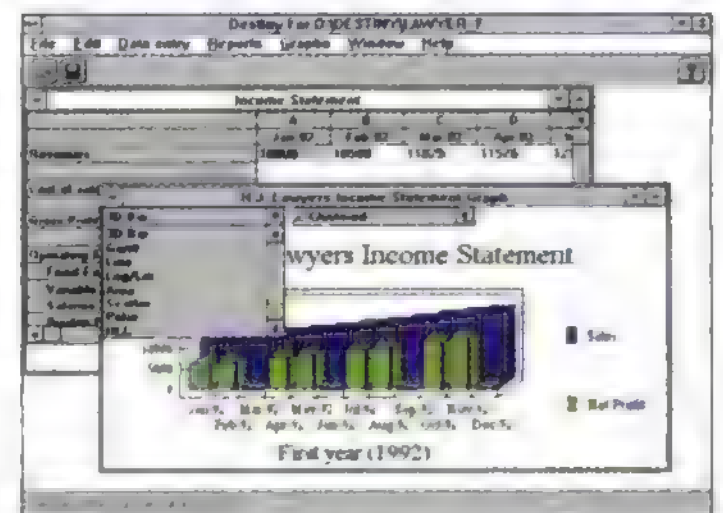
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Planet Corp.

• Destiny Business Information and Planning System

Planet Corp.'s Destiny Business Information and Planning System, Version 1.06, uses Windows resources extensively in its attempt to help you perfect your business plan. Destiny can use other packages—such as Microsoft Word for Windows—in addition to its internal tools. Its business-plan outline and guidance aren't nearly as fleshed out as those in the other products reviewed here, but its financials and internal charting and graphing capabilities are especially strong. The package has a \$129.95 introductory price until this December; it will then rise to \$249.

Destiny can be viewed as both a standalone application and a package that works with other Windows applications. You might, however, go so far as to say that Destiny relies on other Windows



Destiny offers liberal graphical options for charts and graphs within your business plan.

applications. For example, you can choose to import financial data into Destiny's own internal spreadsheet in ASCII format, cut and paste using the Windows Clipboard, or enter all of your calculations in the Destiny spreadsheet directly.

To create the text of your business plan, you can open Microsoft Write or Word for Windows directly from Destiny, and Destiny's sample business plan will be automatically loaded. Or you can use Destiny's own text editor, a very simple applet that loads only a simple version—not the expanded version—of the outline. (You can also follow along in the manual.) In the written part, then,

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Destiny might be said to favor external applications.

Destiny's depth in terms of on-line explanation and guidance doesn't approach that of most of the products reviewed here. To give you a concrete example of how the written section of your business plan might read, Destiny's business-plan outline contains some sample text describing an imaginary company. The first six sections consist of this sample text and, in places, skimpy descriptions of what you should enter. This is followed by a list of suggested charts, graphs, and appendices (the latter would include such things as pictures of the product, résumés, and market studies). Two sample sets of financials are also included.

CLEAR FINANCIALS

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DESTINED

Destiny's integration breaks down a bit when it comes to printing your finished plan. On one hand, you can select fonts and attributes for text created in Destiny's text box (or use Write's or Word for Windows' own formatting), and Destiny automatically dresses up elements such as titles in the built-in spreadsheet. On the other hand, the program does not allow you to merge graphs and spreadsheet data with files created in Write or Word for Windows (although you can, however, use the

Windows Clipboard).

Given its overall outline, financial, and charting capabilities, Destiny appears to be an attractive product. The package's native word processor could use some beefing up, however. Moreover, like every other product reviewed here, Destiny would benefit greatly from some sort of navigation tool.

► **Destiny Business Information and Planning System, Version 1.06.** List price: \$129.95 through December 1994, \$249 thereafter. Planet Corp., 100 Pleasant St., Worcester, MA 01609; 800-366-5111, 508-757-6555; fax, 508-757-2426.

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SoftKey International Inc.

• PFS:Business Plan

PFS:Business Plan, Version 1.1 (\$79.95), manages to be at once affordable and powerful. The package has three separate but well-integrated Windows-based modules—a word processor, chart editor, and spreadsheet—as well as models and templates for text and financial files. On the downside,

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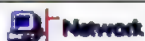
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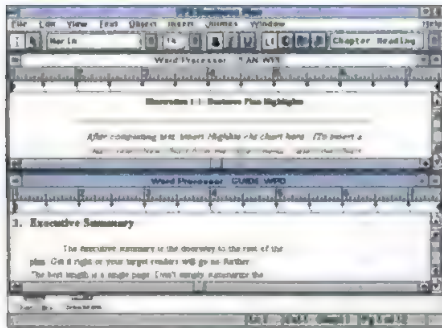
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PFS:Business Plan's outline and text-entry files run concurrently; the chart editor and spreadsheet module are easily accessible.

PFS's on-line guidance isn't the most plentiful—though the documentation is good—and the interface is a bit out of date.

LOADING UP

PFS's word processor comes with two files ready to load: PLAN.WPD, which contains a business-plan outline that you can edit and fill with your own data, pulling in charts where designated, and GUIDE.WPD, which offers guidance on what kind of information is needed throughout. Using these two files simultaneously requires that you open them as two separate windows on-screen and then scroll through them individually.

The package's documentation stresses that most people don't like to read business plans longer than 50 pages long, so the included boilerplate plan is sparer than the plans found in other products, with fewer suggestions and questions. Standard text-formatting tools include those for font and style selection, a search-and-replace tool, and a spell-checker; advanced tools include a thesaurus and support for defining styles and inserting footnotes and objects.

You use the chart editor to open existing chart templates, or build your own charts and drop them into your plan. There are tools to generate nine kinds of charts, including bar, line, pie, and area. You can select fonts and shades; add borders, titles, legends, and grids; and adjust scaling and data gaps.

CHARTING NEW GROUND

The package's financial tools are as thorough as most competitors'. The main spreadsheet comprises several smaller, linked modules, including standard fare

such as sales-forecast and balance-sheet modules. Additional spreadsheet templates track such things as competing products, market forecasts, and materials suppliers. Eleven prebuilt charts materialize when you pour in your own numbers, covering such topics as business benchmarks, cash flow, and sales forecasts. Customization tools let you change height and width, copy and paste, assign

fonts and attributes to ranges of data, and edit text for titles and labels.

When you first boot up PFS, the word processor is open and active, and the other modules are represented as icons at the bottom of the screen. The program's linking and merging capabilities allow for a good amount of integration among the modules. When you link data, the link stays in place, so you can easily

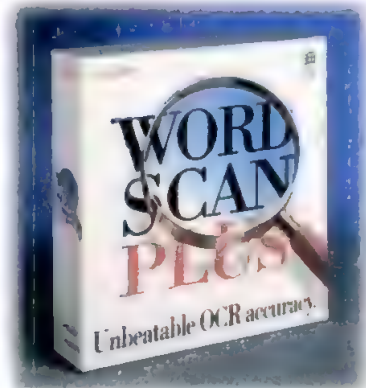
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update new data when the original file changes by clicking on the Refresh Now menu item. Merged data loses its link once it is merged into a file in another module. You can also have the package update everything automatically.

PFS was originally developed and owned by Spinnaker Software Corp. and hasn't been updated since SoftKey acquired it. The current version was actually designed to run under Windows 3.0, but we experienced no operational problems running under Windows 3.1—no problems, that is, once we took the advice of SoftKey's technical support removed the copy of Publisher's PowerPak that shipped on the disks with PFS.

Good integration, ample tools, and a rock-bottom price make PFS a good choice for the budget-minded user. Boilerplate templates and customization options throughout let you create the best plan for your needs. There are more thorough (and more recently upgraded) business-plan programs out there—some of which offer more hand-holding—but PFS is one of the few that lets you create a business plan without tapping into your other applications for help.

► **PFS:Business Plan, Version 1.1.** List price: \$79.95. SoftKey International Inc., 201 Broadway, Cambridge, MA 02139; 800-227-5609, 617-494-1200; fax, 617-494-1219. Circle 474 on reader service card

PowerSolutions

• PlanMaker

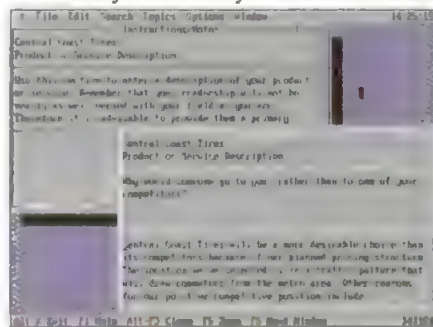
PowerSolutions' PlanMaker, Version 1.03 (\$129), the only DOS-based standalone business planner, is in some areas—mainly those relating to guidance—able to outperform some of its Windows-based competitors. Unfortunately, subpar output, a dearth of graphing options, and limited financial tools place PlanMaker a step below the other products here.

The main business-plan outline uses a multilevel structure designed to give you some space to write rough drafts and easily edit and paste them into your final outline. You can scan the three sample plans included, or plunge right into your own by opening the Workbook.

The Instructions/Notes module consists of topic boxes divided into two sections. The top box outlines the informa-

tion that should be included in each area. Categories in this section include Executive Summary, Objectives, and Market Analysis. You can type in ideas in the lower section, or actually start crafting your copy in the Narrative module. If you need to further formulate your ideas, open the Questionnaire module and answer questions relating to each topic.

When you're ready to move on to the



PlanMaker's Workbook module gives you two levels of data entry and lots of guidance.

Narrative module, the actual data entry section, you can import notes and questionnaires—topic by topic—using the Import command or cut and paste. If you'd rather, you can start with the Narrative module and return to earlier sections, or you can cut and paste from sample plans. The multilevel approach may be overkill for some users, but it can be quite useful for users who are unfamiliar with what's needed in a business plan.

LIMITED FINANCES

All financials are prepared in one very long file. You open it and read through explanatory sections, filling in figures whenever a spreadsheet prompt appears in the file. This section leads you through the creation of reports. Examples of reports are 12-Month Proforma (a formalized financial forecast of expected performance), 3-Year Projected Operating Statement, 12-Month Cash-Flow Projection, Balance Sheet, and Break-Even Evaluation. Your options here are more limited than in other packages, but the introductory explanations provided are more thorough than in most. These reports must be prepared in order, however, and they cannot be printed until they are complete.

Additionally, no graphical charts are available in PlanMaker. The package does, though, offer some supplemental

forms and schedules that may be helpful to include in your plan, such as confidentiality agreements, retainers, and media-buy schedules.

Despite its DOS interface, PlanMaker doesn't suffer much in terms of usability. The 390-page manual is absolutely required—at least in the beginning—because of PlanMaker's unusual structure, but moving around and transferring data between sections isn't a problem once you understand the package.

Printed output is PlanMaker's only Achilles' heel. While there are a handful of DOS text-formatting commands available, you'll have to export the plan to a Windows word processor to achieve acceptable output. Financials print fine, but the look is far from dazzling. Furthermore, you cannot export numbers to an outside spreadsheet for dressing up.

PlanMaker offers unparalleled depth in its business-plan outline—not in terms of the sheer volume of topics, but in terms of the opportunity it offers to craft each topic as accurately and completely as possible. For a package that can combine solid information with attractive formatting and informative graphics, however, look elsewhere.

► **PlanMaker, Version 1.03.** List price: \$129. PowerSolutions, 1920 S. Broadway, St. Louis, MO 63104; 800-955-3337, 314-421-0670; fax, 314-421-0668.

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Business Resource Software Inc.

• Plan Write

Plan Write, Version 3.0 (\$129.95), lacks the depth and no-holds-barred analysis of its more expensive sister product, Business Insight, but this Windows-based product is ideal for anyone who simply needs a framework to produce a business plan and some basic guidance along the way. Like the other products presented in this roundup, it includes a thorough sample plan that users can learn (and borrow) from. It's advisable to use this plan, because while the package's topic outline is quite ample, its guidance is skimpy compared with that of a program such as BizPlanBuilder.

Plan Write consists of an integrated word processor, a spreadsheet, a chart generator, and an outline processor. Creating a business plan is relatively simple. Clicking on the outline-processor icon

SOFTWARE Business Tools

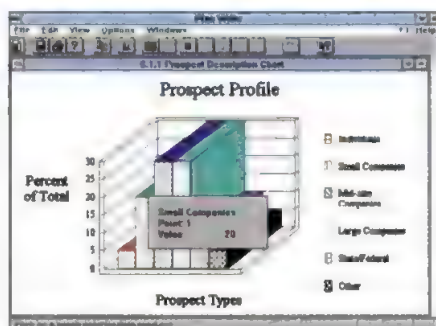
opens the outline file in the program's own word processor. In the outline, you input such information as market details, competition, and financials. You can also add descriptions of the company, people, and products or services. The outline also covers areas that you might not have considered in detail or put in writing before, such as manufacturing costs and value to the purchaser. A click on a topic item opens a new data entry window where you can enter text or data relating to that particular topic. Each outline item can contain text, a spreadsheet, or a graph.

The package includes a spell-checker for text files, font-size and font-attribute control, a search-and-replace tool, one level of undo, ASCII text and RTF (Rich Text Format) import and export, and cut, copy, and paste commands. You can import and export spreadsheet data from Plan Write in .WKS, .WK1, and .WK3 formats.

FILLING IN

Fill-in-the-blank templates lay the initial number-crunching groundwork for the spreadsheets and graphs you'll show to

potential investors. Final reports include 12-Month Detailed Budgets and Cash Flow Projections, as well as 5-Year Income Statements and Balance Sheets. Visuals are customizable here as well; you can specify colors and fonts for each individual spreadsheet cell. Plan Write's



Plan Write can instantly generate numerous kinds of graphs to illustrate your data.

graph generator produces 14 instant chart types, including area, pie and exploded pie, bubble, line, and three-dimensional variations.

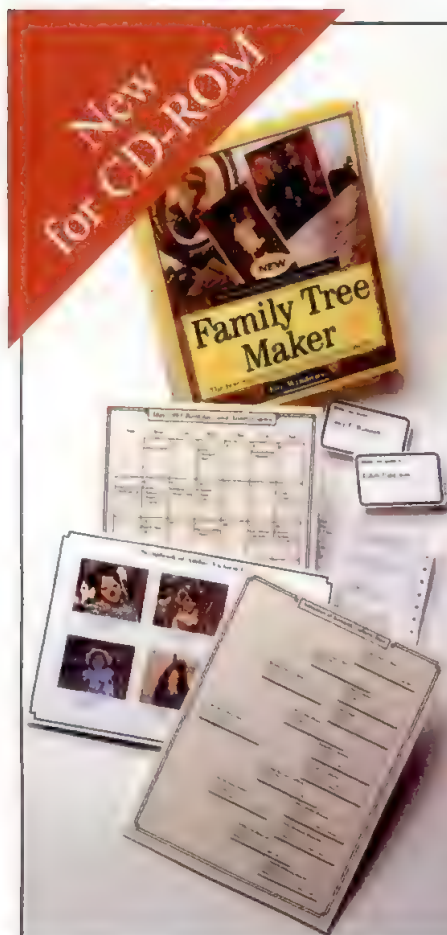
To produce a really dazzling final product, complete with graphics and

other stylized output, you will have to save your file as an ASCII or RTF file and then open it in a Windows word processor. Plan Write will print a copy of your business plan, with charts and spreadsheet data all smoothly integrated, but you will be able only to control fonts and label styles and adjust margins. The boilerplate format is perfectly acceptable, though, for important presentations.

For \$129.95, you could buy a lot of books on business plans and craft your own plan using the more sophisticated tools offered by your word processor and spreadsheet. And though Plan Write is easier to use than the other all-in-one solution reviewed here, PFS: Business Plan, it lacks PFS's integration, formatting, overall customization tools, and attractive price. □

► **Plan Write, Version 3.0.** List price: \$129.95. Business Resource Software Inc., 2013 Wells Branch Pkwy., #305, Austin, TX 78728; 800-423-1228, 512-251-7541; fax, 512-251-4401.

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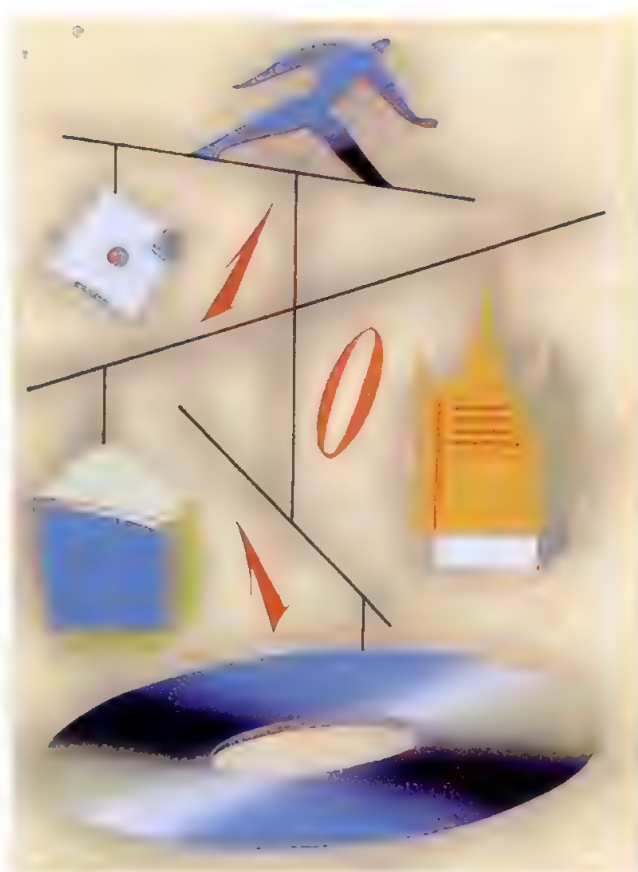
NETWORK MANAGEMENT

Who's Minding Your Network?

Network management is a virtual job, changing all the time. You need a coordinated reach past your office door.

By Frank J. Derfler, Jr.

The person each company calls its "network manager" is part technician, part programmer, part accountant, and part politician. The tools this person uses are just as diverse—ranging from physical devices (such as special pliers for crimping cable connectors) to software spreadsheets for budgeting to packages for a variety of network management tasks, many



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H I G H L I G H T S

Network Management

SOFTWARE SUITES work as well for areas like network management as they do for mainstream applications. They're a win-win proposition here. Network managers get a group of applications with a consistent interface and sometimes a shared database. They enter setup information just once for a whole string of utilities. On the flip side, the bundling of applications allows vendors a reasonable pricing margin, where some single-function products in this area may not.

THE INTEGRATION AMONG various modules from a company, which contributes mightily to the success of the suite, has improved over the past year. More products share interfaces, databases, and features. Frye Com-

puter Systems continues to do it better than anyone, although other companies (including Symantec Corp. and Saber Software Corp.) are coming along.

HARDWARE AND SOFTWARE inventory continues to be the cornerstone utility of the suites. If you do nothing else to monitor your network, you usually want to track your assets. Interestingly, these are two very different kinds of activities for the software. We observed a surprising range of depth and breadth in this area.

APPLICATION METERING and software distribution have emerged in a big way over the past year as important and very useful utilities. Metering can

play a big part in saving your organization money on unused licenses, and it can help you make the arguments for more hardware and software when you need to. It can also keep your company out of legal trouble where licensing is concerned. Software distribution is a godsend for any network manager who's ever tromped from cube to cube installing updates.

AFFORDABILITY IS KEY. Especially for a small to medium-size network, it can be tough to justify spending large amounts of money for network management. Still, each package more than pays for itself the first time you avert a major problem—or even lots of minor ones—just because you had it installed and were using it.

of which we examine here.

Because the job can be many things, companies in the network management software business have different ideas about what a network manager needs in a suite of useful software utilities. Some suites focus on regulating the use of applications, while others ignore that task. Some include virus checking and file backup; others do not. Most products gather operating statistics from the server, but a few don't. This diversity gives you an opportunity to choose the toolkit that you think has the right blend of functions and perhaps augment suites with pieces from other vendors.

CASTING FOR SUITES

When we set out to gather a group of management suites with comparable features, we had to use a big net. We started by identifying the many functions they might perform. Then we narrowed that list down to a group of seven often-used functions and accepted a product or group of products for review if it performed any four of the seven (see the Suitability to Task key). Each of these suites also offers functions that are not on the list (see the table "Which Does What"). We specified that the products

must work with Novell NetWare because of its large market share, but many of these products cross over network operating systems.

The products that stayed in the net are McAfee Associates' BrightWorks, Version 1.1; Intel Corp.'s LANDesk Manager, Version 1.51; LANlord, Version 2.1, from Symantec Corp.'s Central Point Division; Cheyenne Software's Monitrix for NetWare, Version 3.0; Symantec Corp.'s Norton Administrator for Networks, Version 1.0; Saber Software Corp.'s Saber LAN Workstation, Version 5.0; and Frye Computer Systems' The Frye Utilities for Networks.

Obviously, this approach leaves out many less-integrated but still excellent products. Shany's AlertView, CheckIt LAN from Advanced Systems Research, and BindView NCS from the LAN Sup-

port Group, for example, are each handy tools for hardware and software inventory and server monitoring—but they didn't have enough other functions to be comparable with the seven suites in our roundup. We've also included three sidebars that discuss several products representative of some key network management areas.

In addition, it was not our intent to include the network backbone management systems that use the Simple Network Management Protocol (SNMP) to manage and gather information from network devices. Although some of the reviewed products (such as Intel's LANDesk) can send information to SNMP programs, none of them can gather and display the information provided by SNMP-equipped network products. A separate class of Microsoft Windows-based back-

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bone management products is covered in the sidebar "Platforms Port to Windows."

WHICH COMPANY SELLS WHAT?

Software suites of all kinds evolved from two separate trends: low pricing and high ease of use. From the vendor's point of view, software prices have been squeezed so often that there isn't enough margin in relatively small, single-function programs to provide marketing and technical support.

For the users' part, people don't want to spend time learning new menus or sets of actions. They don't want to have to enter identical parameters in similar programs. Ideally, integrated suites address both pressure points: They provide a common framework, share setup information, and allow vendors a reasonable margin to make a successful product.

This segment of the software industry has gone through a series of mergers and acquisitions. The vendors have changed over the last year, as have their products. If you bought utilities last year and want more from the same company, you might have to do some work to track them down.

For example: McAfee Associates, a company that is very successful in virus protection, now owns Brightwork Development. The BrightWorks products are available through McAfee's unique online distribution and sales system. Symantec, well-known for its Norton line of utilities, now also offers the Central Point suite of products. Some veteran products, such as Carbon Copy and pcAnywhere remote-control programs, are now part of management suites. Here's how we defined this tough-to-define area.

FIRST, TRACK YOUR ASSETS

Network administrators are always calling for ways to inventory and track their growing investment in network assets, and the designers of network management suites have responded. Inventory control is a capability that all of these products have in common. When an organization has hundreds or thousands of nodes, managers must know the total inventory of hardware components and application programs and where the pieces reside at all times.



• The Frye Utilities for Networks

We first looked at network management utilities as suites of products about a year ago. We found that the quality of the utilities was pretty good, but that there was very little integration within lines of utilities from the same vendor.

Even back then, The Frye Utilities for Networks (FUN) was our Editors' Choice; it was leading the way in establishing the fact that network utilities should work together to provide useful information and increase productivity for the network manager.

FUN is our Editors' Choice again; the company continues to excel at integrating its first-rate utilities for managing networks of all sizes. Of course, this year we again looked at the quality of implementation for each of the individual modules within the lines. And once again, FUN's utilities are consistently rich in features, easy to install, and easy to use. Its hardware and software inventory is a good example: It inventories both clients and servers in detail and recognizes several network operating systems. In addition to DOS and Microsoft Windows client systems, FUN inventories Macs.

Remarkably, it is the only product here that does not have a Windows interface. But we find its DOS-based menu system well executed, easy to use, and intuitive. It's a NetWare-like interface that many network managers are used to, and it in no way detracts from making full use of the fine utilities.

Packaging is another interesting point of differentiation. Although a complete packaged suite of utilities appeals to us, so does Frye's approach of

offering separate modules. You can buy the pieces you want and add as you go, knowing that they'll all work well together thanks to the good integration. And, although Frye's products are at the high end of the price range here, you get what you pay for: Their quality makes them a good value.

Finally, Frye has definitely focused on the network, with excellent server monitoring capabilities and software distribution facilities, among other things. It's a very complete solution in which to put your trust. That's important to network managers.

We also wanted to give honorable mention to two other suites of products: Symantec Corp.'s Norton Administrator for Networks and Saber Software Corp.'s Saber LAN Workstation and its accompanying products. The Norton Administrator for Networks has a particularly good interface and integration of its modules. It does a lot of things well and is very affordably priced, but it didn't cover the pure networking areas as well as FUN did.

The Saber suite was also well integrated and well priced. Although its utilities are not quite as in-depth, it covers a good range of management tasks and has strong application metering. Installation and ease of use could be better, but Saber LAN Workstation is well worth considering.

Creating a hardware inventory and a software inventory, though, are two very separate tasks. When a program creates a software inventory, it runs through the directories and tries to match executable files to its database of known products. The database might have thousands of products, but it's a simple job. Taking a hardware inventory is much tougher.

Hardware-inventory software interro-

gates the PC's BIOS and subsystems so it can provide valuable reports on installed memory and available hard disk space. But there are only a few things it can do—such as looking for special drivers in memory—to report what might be going on in the system bus.

Hardware inventory will take an evolutionary step in 1995 when products supporting the Plug and Play (PnP) and

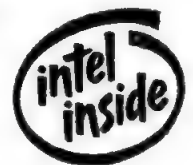
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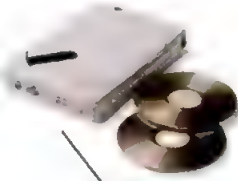
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Suitability to Task: Network Management

Network management encompasses a wide range of computing activities. We started with a large number of tasks and narrowed it down to a list of seven of the most prevalent areas of functionality. The suites in this roundup were required to do any four of the tasks. For easier comparison, we list all seven tasks for each package (or set of packages). We've indicated an N/A (not applicable) where a particular task is not included in that company's offering. You can also refer to our matrix of "Which Does What" for a quick cross-reference of which vendors offer which features.

Hardware and software inventory (HW and SW inventory) is one of the most basic but important capabilities a network manager needs. First, we look at the utility's range and give extra points if it inventories both the client PCs and the file servers. We then take into account whether the inventory utility provides a central database for integration with other utilities, such as application distribution and metering. We also consider the operating systems that the utility supports and whether the inventory is automatically run in real time or instead loads when the user logs on.

For hardware, we note the types of items the application inventories, including CPU and installed cards; it even lists the manufacturer in a few cases. We look at how well it interrogates the system's BIOS and subsystems and give additional points for depth and detail.

When we look at software inventory, we note the number of applications monitored in the inventory and how well the utility detects all the drivers present.

Under **server monitoring**, we note what the utility monitors, including CPU utilization, file-system performance, volume and disk status, network error counts, packet statistics, and card status. We also look at a utility's ability to perform memory-allocation monitoring. We check to see if the suite monitors hard disk and volume space, packets, and whether it addresses security issues. We give additional points if the server monitoring utility monitors more than just file servers, such as print servers and communications servers. We also give credit for easy-to-understand and well-designed graphical displays.

To score well on **client monitoring and control (Client control)**, a utility needs to offer more than a view of remote clients. We look for the ability to provide remote control both across the network and over a modem link. We also consider depth, a utility gains additional points if it allows you to view statistics and update and modify configuration files and environment variables. Can you view the client configuration files (AUTOEXEC BAT, NET CFG, WIN INI)? We give extra credit when the utility allows the network manager to reboot a remote client from the local network-management control console.

Where a suite offers **network traffic statistics (Network traffic)**, we note at which layers of the OSI model the statistics are gathered, whether layer 2 (media access layer), layers 3 and 4 (network, IPX, etc.), or even layer 7 (application). We note whether traffic was tracked at more than one layer. We examine the depth of the statistical data a utility gathers, and note whether the utility uses aggregate or average utilization filters. We also note whether you can gather statistics by MAC address or by user. At a minimum, the utility needs to offer real-time statistical data. We give extra credit for the ability to gather and provide historical data.

Under **application metering**, we look in particular at the breadth and richness of the utility. We give additional points if the application metering utility can meter software on client PCs as well as on servers, metering across servers also gains extra credit. We note the breadth of the license enforcement options, whether the utilities are passive or active, and whether they keep an ongoing audit log. When looking at the metering category, we examine the options for notifying users of license issues: Does the utility only warn users, or does it notify them and then place them in a queue until a licensed application becomes available? We also consider whether current users are notified that other users are waiting to access the application.

When looking at **software distribution**, we examine the distribution script capabilities for ease of use and power, with ease of use being the more important consideration. Better utilities are those that integrate well with the suite's inventory utility. Another feature we note is when distribution

occurs—at log-on, at set dates and times, at the user's request, or at the network manager's request. We note whether users can opt not to accept software or an upgrade. A software-distribution utility also gains extra points if it allows you to collect configuration files for modification. Finally, we look at whether the utility keeps a status log of distribution jobs.

Under **virus protection**, we note whether the

antivirus software lives on the server or the client and whether it can scan both. Integration is a big consideration here as well. Better utilities are easy to use and can scan for a large number of known viruses. We note when the antivirus software runs, either at boot-up or log-on or at user-specified times. We give additional points when you are able to schedule scans to run automatically.

We also decided to rate **integration** within each suite. We look at both external integration and internal integration. For external integration, we give credit where the modules

share a common interface, whether graphical or DOS-based. We note its ease of use and whether it is intuitive. In addition, we give extra points for customization capabilities. Equally as important (and possibly more so) is the internal integration. In particular, we note when utilities built, maintained, and reported information from a common database. We also give extra points when two or more utilities are able to share information in doing their jobs—such as the hardware and software inventory module being able to work with the application metering utility.

Note also that we consider two features—reporting and alerting and notification capabilities—across all seven functional task areas. For reporting, we consider the ease of use of creating reports, whether reports are graphical in nature, the quality and facility of the scripting language, whether predefined reports are available, and the level of detail included in reports.

Products that score better on alerting and notification are able to notify the network manager by broadcast message, e-mail, fax, printer, or pager. It should be easy to set thresholds, and thresholds should be available on as many trackable items as possible. Finally, not every utility in every suite offers reporting and notification—we give extra credit to those that are.

SUITABILITY TO TASK

Product Name

HW and SW inventory	POOR
---------------------	------

Server monitoring	FAIR
-------------------	------

Client control	GOOD
----------------	------

Network traffic	EXCELLENT
-----------------	-----------

Application metering	POOR
----------------------	------

Software distribution	FAIR
-----------------------	------

Virus protection	GOOD
------------------	------

Integration	EXCELLENT
-------------	-----------

N/A	Not applicable	The product does not have this feature
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Network Management

Desktop Management Task Force (DMTF) standards enter the market (see "The DMI from the DMTF: Just Another Standard?"). But PnP and DMTF don't help to catalog the billions of dollars

in the organization with ten disks containing the latest corporate applications. Distributing software manually takes a huge amount of time.

A software-distribution utility is one of

wider variety of packets and provides more options.

Equally as important as the gathering of numbers is their presentation. NetWare has the internal tools to generate a lot of server statistics, but it does a mediocre job of presenting them. The majority of the management suites in this roundup can take statistics from NetWare and make the numbers jump through hoops. You can use numbers on server CPU utilization, disk utilization, caching, available communications buffers, and dozens of other factors to generate trend charts for budget meetings or to set off alarms for emergency response.

The quality of reporting is important because statistical reports don't have much punch if they're hard to understand. Most products come with predefined reports that do a good job; they can export records in common database formats. But Cheyenne bundles the well-known Crystal Reports software with Monitrix, so you have a lot of flexibility in how you present your information. Most programs can also work with a telephone dialer to initiate a call to a beeper when they detect certain problems.

PROTECTION FOR YOUR CONNECTION

Networks rarely act as a conduit for virus infection, but they make a good tool for virus eradication. If virus-checking products work in the client PCs, then bootup is delayed. Or in the case of products that work only under Windows, viruses can sneak in on floppy disks (before Windows starts up). If a virus-protection program loads in the server, as McAfee's NetShield NLM does, it takes over server assets and might reduce overall throughput. Our functionality matrix "Which Does What" shows all the products with virus protection reviewed here.

BETTER THAN NETWORK?

Novell's NetWare has its own suite of utilities that are not very tightly integrated (particularly SYSCON and MONITOR) and are used to create new accounts, name and allocate resources, control printing, and report on server operation. (See "Going Beyond Your NOS.") Frye Computing Systems specializes in producing utilities that put a better face on NetWare. Other compa-

Which Does What

■ YES □ = NO

Tested Network Management Abilities

	McAfee Associates BrightWorks	Intel Corp. LANDesk Manager	Symantec Corp. LANtord	Cheyenne Software Inc. Monitrix for NetWare	Symantec Corp. Morris Administrator for Networks	Saber Software Corp. Saber LAN Workstation	Frye Computer Systems Inc. The Frye Utilities for Networks
Hardware and software inventory	■	■	■	■	■	■	■
Server monitoring	□	■	□	■	□	■	■
Client monitoring and control	■	■	■	□	■	■	□
Network traffic statistics	□	■	■	■	□	■	■
Application metering	■	□	■	□	■	■	■
Software distribution	■	□	□	□	■	■	■
Virus protection	■	■	■	■	■	□	□

Additional Network Management Abilities

Notification and alerting	■	■	■	■	□	■	■
Reports	■	■	■	■	■	■	■
Automation and scheduling of tasks	□	□	■	■	□	■	■
Replacement for NetWare utilities	□	□	□	■	□	□	■
Back-up	□	□	□	□	□	□	□
Mapping	□	□	□	□	□	□	■
Print queue management	□	■	□	□	□	■	■

worth of hardware pieces already installed. Without the cooperation of PnP or DMTF-compatible products, it's hard for inventory software to discover and identify LAN adapters, video cards, and other devices in the system.

METERING PROVES WORTHWHILE

The next step beyond reporting the presence of an application program is to control its use—a function called application metering. Properly implemented, metering saves your organization money, because you buy only enough copies or licenses to meet the daily need—instead of buying one for each potential user.

But metering can become a corporate culture issue. Sometimes the metered programs must reside on the server, so they aren't available if the LAN is down. If your corporate management is afraid of lawsuits for license abuse and metering is stringent, people will either be locked out or receive strident messages when the organization exceeds its license level. You have to sell metering to both management and to users; you also must customize it to make it effective.

PASS IT AROUND

Ideally, your social life doesn't consist of going from cubicle to cubicle to every PC

the newest functions found in some network management packages. As the number of networked nodes grows, the job of updating the software on each hard disk gets tougher and tougher. Centralized software-distribution systems use special programs loaded onto each node that draw updates from the server. These centralized software-distribution products make good use of the network to increase your productivity.

NUMBERS UPON NUMBERS

Many of the remaining features of these network management suites have to do with statistics and reports. Statistical reporting systems can help you spot trends, troubleshoot problems, and plan budgets. But we saw lots of differences in the types of statistics and where the programs gather the numbers.

Because there is so much activity on the network cable, statistical sampling is the best way to measure its health. Traffic-counting programs can identify specific nodes by their adapter address, alert you to unauthorized access, identify usage trends, and help isolate cable problems. Intel's LANDesk, Symantec's LANlord, and Cheyenne Software's Monitrix do a good job of measuring and categorizing network traffic; LANDesk identifies a

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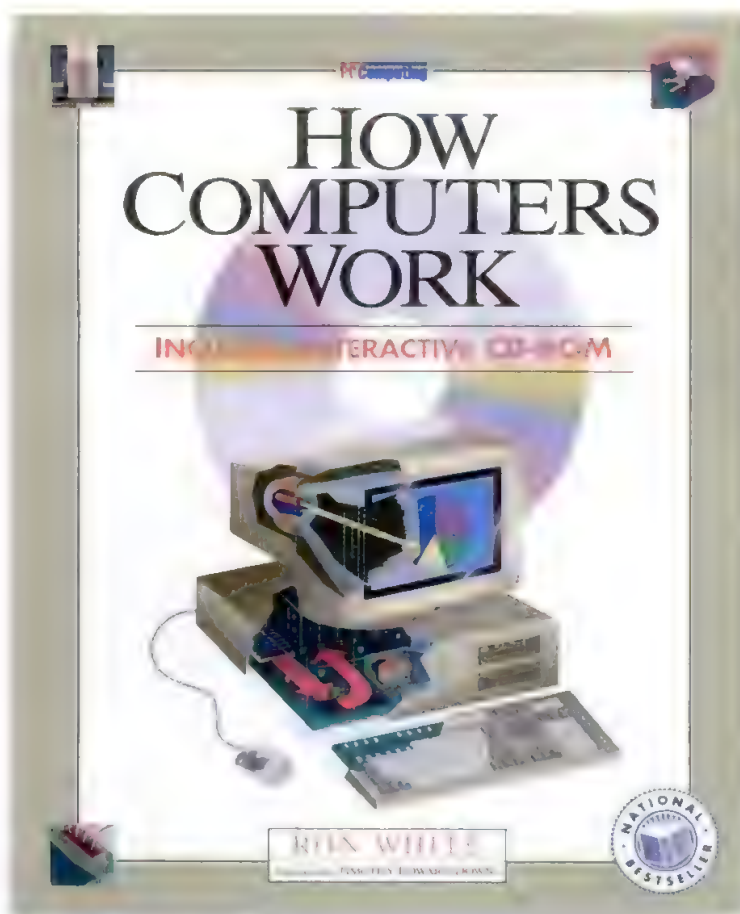


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BANG



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nies, including Saber Software, have followed along. These NetWare-alternative products work just as well as the original and often make specific management actions easier for new administrators or assistants.

SUITES FOR YOU

Our reviews provide specific information on the degree of integration between the products in the suites and their principal areas of focus. Selecting the right set of management tools can improve your productivity, improve planning, and reduce costs across the organization.

McAfee Associates

• BrightWorks, Version 1.1

BY STEVE RIGNEY

Version 1.1 of McAfee Associates' BrightWorks (formerly Fusion, from Brightwork Development) provides a good mix of network management utilities, including hardware and software inventory, application metering, remote control of clients, virus prevention, and a help-desk utility. But it lacks some key network features, such as traffic and server monitoring. If you need those features,

you'll have to look elsewhere. In addition, if you need to monitor applications on client PCs, you should look at another management suite, such as Norton Administrator for Networks.

BrightWorks is offered in a unique purchase format. All of McAfee's products are available for free evaluation from the company's BBS and from other on-line systems. If you like the product, you pay for the licenses and upgrade support. This direct sales channel seems to work: These Microsoft Windows-based management utilities start at \$55 per node (for up to 10 clients) and can retail

Perfect Network Management

By Robert P. Lipschutz

There's no question. Network management utilities have been a boon to network managers. Dozens of utilities offer useful features for handling your precious assets. But instead of just looking at the features in a package, you should also examine how well the products prevent and solve your network problems.

In our roundup, we look at suites that attempt to solve most management problems. Although useful, most network management applications today (including these) don't often provide the most meaningful information to solve many network problems easily. Networks are complicated, but the perfect network management application should cut through entanglements to uncover the problems and suggest solutions to the busy network manager.

CONSIDER THIS

Think about the problems you have on your network. Then think about the information you really need all at once to solve them. Here are a few typical situations:

Joe from Accounting can't print, and his report is due in 15 minutes. You can hear the terror and frustration in his voice. To solve this problem, you would want the following informa-

tion integrated into *one management screen*: printer and print-queue status, the application Joe is printing from, and his print driver.

Then, you could follow the print job to see where the problem is and quickly solve it. You might find that Joe was using a PostScript print driver while sending his job to a non-PostScript printer. Redirect Joe's job to a PostScript printer and everyone is happy.

Jean from Sales says the network is slow today. She's not the first to call with this complaint. You need to get the following information—*on one screen*: Jean's desktop status (including memory available), the application she's using, the state of the server she's accessing, and network utilization. You need both historical and real-time information to see what has changed. You notice network utilization is high and trace the problem to Joe's 20 identical print jobs being processed on Jean's server. You delete the jobs and she sees a big difference.

Right now, trial and error is unfortunately the most common approach to troubleshooting network problems. Without the necessary tools to diagnose the problem, you have little choice. The perfect network management application will have all the relevant data integrated into one usable whole. It will provide integrated

information on desktops, applications, servers, segments, routers, and printers—everything you need to resolve problems intelligently.

VISUALIZATION TECHNIQUES

But even having all the data in one place is not enough—that data must be processed. Your network management application must turn data into accessible, helpful, graphical information.

Many management applications today are inept at displaying all the information in a useful way. You get volumes of data, but figuring out what it means often falls on you. Graphical representations should be the norm—take those numbers and turn them into comparative bar charts or pie charts. Take those tables of numbers and provide tools to sort and select the useful information. Add information trees that make sense out of nonsense. Lead the network manager in the right direction. The display should actively show problems and suggest solutions.

JUDGE FOR YOURSELF

In the final analysis, actions speak louder than words. While we're looking for perfect utilities, we must recognize a job well done. Today's network management applications provide more value than yesterday's. Tomorrow's should be even better. □

How We Evaluated Network Management Suites

In looking at these seven network management packages, we tested the strengths of individual modules as well as the integration among them. We found integration much improved in this year's group of network management suites compared with last year's.

There are dozens of network management functions. We identified seven of the most popular and looked for each of these suites of utilities (whether bundled or not) to have some combination of four functions to be included in this roundup. We were looking to test not only the network management functions but also how well integrated the various utilities were within each suite—that is, how well they worked together. Integration includes a common interface throughout the utilities and sometimes a shared database. Performance issues are not pertinent with these packages.

To test each package or set of packages, we installed the software on our test-bed file server. We operated the utilities of the following suites from a Microsoft Windows system: McAfee Associates' BrightWorks, Version 1.1; Intel Corp.'s LANDesk Manager, Version 1.51; Symantec Corp.'s LANlord, Version 2.1, and Norton Administrator for Networks, Version 1.0; Cheyenne Software's Monitrix for NetWare; and Saber Software Corp.'s Saber LAN Workstation, Version 5.0. Frye Computer Systems' The Frye

Utilities for Networks ran under DOS, and LANlord requires an OS/2 system to track network activities.

We ran each reviewed utility through its paces on the test-bed network. In the reviews, we also note other capabilities of the packages that were not tested here.

We connected all of the test-bed systems in an Ethernet star configuration. Two Compaq ProLinea 486/33s running DOS 6.2 and Windows 3.1

Network Management Test-Bed



were set up as our standard clients. Each ProLinea had a Novell/Eagle NE2000 16-bit ISA Ethernet adapter installed with Novell's VLM 1.1 client drivers.

In addition, we used two Compaq Deskpro 486DX/66M systems configured as file servers. One Deskpro was running Novell NetWare 3.12; the other, OS/2 2.1. We installed a Novell/Eagle NE3200 EISA Ethernet adapter in the NetWare file server and a Novell/Eagle NE2000 16-bit ISA Ethernet adapter (using the OS/2 NetWare Requester) in the OS/2 system.

for as low as \$24 per node (for 1,000 clients).

The BrightWorks interface is well integrated, with a console screen that lets you control all of the individual modules (as icons) from one Windows menu system. The interface is similar to that of Norton Administrator for Networks. BrightWorks uses NLMs to perform software metering, so you can use the product only with NetWare 3.x or higher. Its distribution and metering utilities are linked to its inventory database.

Like Saber LAN Workstation, BrightWorks may look intimidating at first. It comes with a 700-page installation manual, and the installation procedure requires you to set up and install the client software and the server NLMs. Plan on spending several days just getting familiar enough with the product to feel comfortable using it.

BrightWorks can inventory hardware

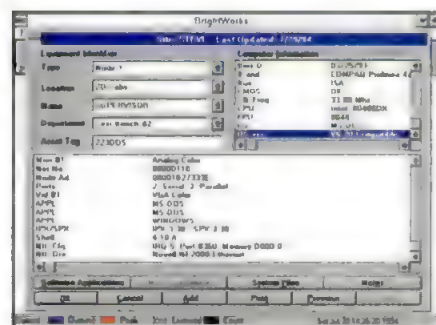
and software on your client PCs and your NetWare file servers. It supports DOS, Windows, and Macintosh systems. The package uses a DOS executable (.EXE) file on the clients and an NLM on the server for

application metering. You can configure the .EXE file to perform a hardware, software, or combination scan of clients at a specific time on a designated day of the week or month. BrightWorks currently recognizes about 2,000 software titles in its database, and McAfee plans frequent updates to the list, available via its BBS. You can manually add titles as well.

You can also use filters to create status reports on your inventory. BrightWorks includes predefined reports that contain a header and columns of data. Overall, BrightWorks' reports have a more professional appearance than those of Saber LAN Workstation or The Frye Utilities for Networks—although they contain the same information.

SUITABILITY TO TASK

BrightWorks	
HW and SW inventory	EXCELLENT
Server monitoring	N/A
Client control	GOOD
Network traffic	N/A
Application metering	FAIR
Software distribution	GOOD
Virus protection	EXCELLENT
Integration	GOOD



McAfee's BrightWorks offers you an easy-to-use hardware inventory module.



BrightWorks also provides user-definable scripts for easy software distribution.

VB Power



ISBN: 1-56276-073-4
Price: \$34.95

This innovative guide by Dan Appleman turns Visual Basic programmers into power users by illuminating the tools of the Windows Application Program Interface (API). Includes a time-saving disk that contains source code from the examples in the text, plus a specially designed dynamic link library (DLL).

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NETWORKING

Network Management

Justifying Network Management To Your Management

By Robert P. Lipschutz

After you've already spent thousands (or hundreds of thousands) of dollars outfitting your network and users with all the necessary hardware and software, it may seem tough to convince your boss that you still need to spend several hundred or thousand more on special software just to manage the thing properly. You may be replacing outdated network management tools or simply adding to those you have.

What's the best way to convince your management that network management is not only a necessary expenditure but will also yield benefits many times over? You might get away with a dog and pony show highlighting the bells and whistles of that desired package. But in today's tight fiscal times, most managers are more impressed by strong cost arguments.

Try using the following two-step approach. If you handle these steps properly, you should have no trouble convincing your manager that network management applications save the company money.

Step 1: Prove that network problems cost the company money.

To do this, you've got to determine how much money downtime costs your company. This will be different for each kind of business. If your company does direct sales, this becomes a rather straightforward calculation. Just take a look at the standard dollar

sales supported by the networked systems that could currently be down for various amounts of time.

In other situations, you'll need to calculate how much each person's time is worth using approximate salary information and other fixed costs. Calculating less tangible costs will be trickier, but worth your while. Remember, too, that in business today, workers are dependent on each other—so the cost of one person's downtime is felt across the company. Factor these costs in as secondary effects.

Step 2: Show that network management applications reduce network problems.

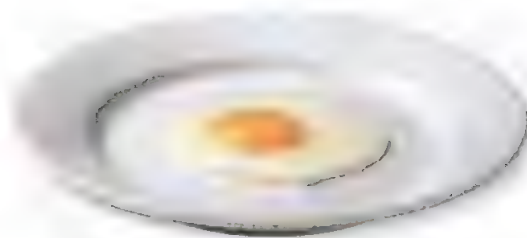
Identify specifically those network problems you will be able to solve or minimize with the appropriate network management application. You must be honest here, or it will cost you later when you cannot do something you've promised.

Tell your manager that without the proper tools, you often don't have any idea about what is happening on your network. On the other hand, don't overstate what network management can accomplish: You may win the battle but lose the war. The truth is that a realistic appraisal of network management benefits against the possible losses calculated above can provide plenty of justification for even the most penny-pinching manager. □

BrightWorks allows you to meter only applications that are located on the server—not those on clients. Other products, such as Saber LAN Workstation, allow you to meter both. (McAfee Associates says it plans to add client metering in the next release.) If there is only one copy of an application on the network, you can use the file browser to find it—you don't have to know its path. If there is more than one copy, you also need to know the path. We'd like to see the software metering module more tightly inte-

grated with the software inventory database so it can provide you with a list of possible metered applications. (McAfee says Version 1.2 of BrightWorks will have improved software metering.)

You can use BrightWorks to distribute applications and updates to all network clients. The scripting language lets you write your own distribution procedures or choose from several predefined scripts. Although BrightWorks' scripting language is not as robust as Saber LAN Workstation's, it is much easier to use.



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Building on the power of people.

Platforms Port to Windows

By Steve Rigney

The products in our roundup inventory your network, meter and distribute applications, and manage file servers. They're probably all you need to manage a small to medium-size LAN. But they fall short when you must track critical internetwork backbone links such as routers, bridges, and hubs.

Another class of network management products relies on the Simple Network Management Protocol (SNMP) and other standards to deliver detailed reports and maps of all connectivity devices across your network. You can combine these backbone network management platforms with the utilities in the suites to provide complete control of your network.

Backbone network management platforms were originally written for Unix workstations on large TCP/IP networks. They query management information bases (MIBs) of statistical data in network devices, gather the data, and present it in graphical reports.

Over the past year, these programs have been ported to Microsoft Windows and now work with other protocols, including IPX. Three popular packages are OpenView for Windows, from Hewlett-Packard (800-752-0900); NetWare Management System (NMS), from Novell (800-453-1267); and VisiNet for Windows, from VisiSoft (800-847-4638). Each lets you create a graphical map of your network, monitor nodes, receive reports and alarms, and control backbone devices that support SNMP.

Because these products use TCP/IP to manage and control your SNMP agents, you need to be familiar with all your TCP/IP addresses and domain and host names. Compared to products in the main article, these management platforms require more time to install and configure. It will easily take a week or more before you're completely comfortable with any of them.

These platforms inventory all of your network clients, servers, and other devices. But they don't offer the same detailed inventory information as the reviewed products. Unless you have an SNMP or other agent installed in client PCs, the only data you can gather using these platforms is the Ethernet and media-layer addresses of each client and server.

THREE PORTS IN THE STORM

OpenView for Windows Workgroup Node Manager 1.0 lists for \$1,495 and accepts data over both IPX and TCP/IP networks. It is integrated with all HP management platforms, and you can pass management information to Unix-based workstations running OpenView.

OpenView for Windows automatically searches and maps all IPX and IP devices and creates a graphical map of your network. Each map can contain submaps of networks in individual cities or even floors or rooms of an office building. In addition to such SNMP features as mapping, automatic discovery, and trap management, OpenView for Windows has enhanced alarm notification, remote control, and Visual OpenView for creating modules.

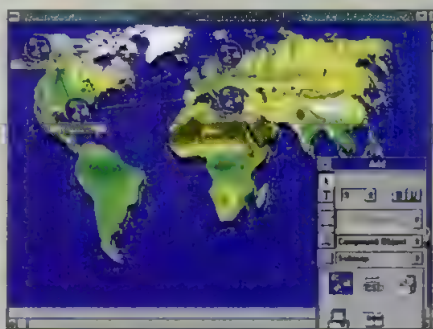
OpenView for Windows comes bundled with licensed versions of FTP Software's PC/TCP, Intel Corp.'s LAN-Disk Desktop Remote, and Ex Machina's Notify! Connect. PC/TCP is a full WinSock- and WinSNMP-compliant TCP/IP protocol stack that includes FTP, telnet, and SLIP and PPP dial-up connections. Desktop Remote lets you remotely control any local or remote PC on the network. You can configure

Notify! Connect to page the network manager when OpenView detects any conditions you set up. It also includes a MIB compiler that you can use to create your own MIBs.

The idea behind Novell's NMS is to provide a scalable management platform for both small and large networks. NMS 2.0 lists for \$2,495 and contains

many of the same features found in OpenView. If you add the \$2,495

NetWare LANalyzer Agent and the \$395 to \$495 NetWare Management Agent, you can monitor all of your NetWare 3.x/4.x file servers as well as network traffic on



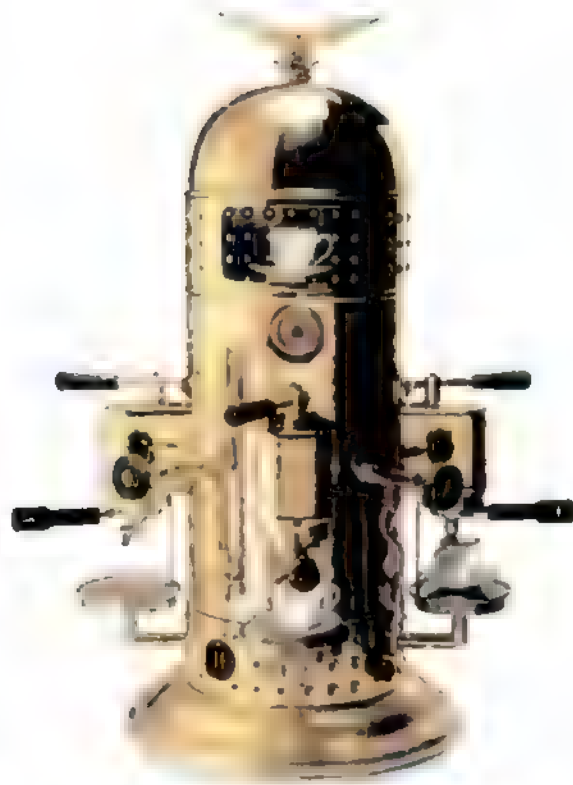
You can use HP's OpenView for Windows to create a graphical map of your network.

segments. The modules provide the same information you normally would have to use a management program and a network cable sniffer to gather.

The NMS platform is just one module in Novell's NetWare Distributed Management Services (NDMS). NDMS is an open system for distributed management of every hardware and software component on the network. Both HP and VisiSoft have announced plans to support NDMS.

VisiSoft offers several unique features in addition to those it shares with the other platforms. For example, various VisiNet modules work over different protocols. So you can use VisiNet to manage LANtastic, NetWare, and Microsoft Windows for Workgroups networks.

VisiNet for Windows 2.5 lists for \$795 for a single-server license. An SNMP version that retails for \$1,995 lets you monitor and control the SNMP agents on your network. VisiNet does not offer remote control, but it is less expensive and easy to use. □



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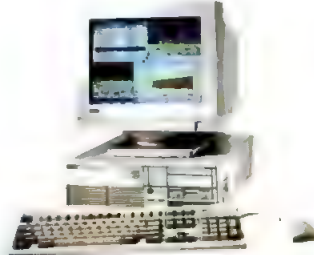
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- **Processor:** IntelDX2,™ IntelDX4™
- **Disk drive:** 3.5" 1.44MB
- **Bus:** PCI/ISA
- **RAM:** 8MB to 128MB
- **Secondary cache:** 256KB
- **Hard disk:** 270MB (540MB optional)
- **Slots:** 1 ISA, 1 PCI/ISA, 1 PCI
- **Graphics:** S3™ 864 with Hawkeye drivers
- **Monitor:** 14" SVGA color
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- **Hard disk:** 270MB (540MB optional)
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- **Secondary cache:** 256KB to 512KB
- **Hard disk:** 540MB
- **Slots:** 3 ISA, 1 PCI/ISA, 1 PCI
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FACT FILE

BrightWorks, Version 1.1

List price: Ranges from \$55 per node (for 10 clients) to \$24 per node (for 1,000 clients). **In short:** BrightWorks, Version 1.1, offers an intuitive Microsoft Windows-based interface, and you can run all of the individual modules from one console. The package has plenty of functionality, including software metering and distribution (which could be more tightly integrated), notification, and remote control of client PCs. But it lacks the more network-intensive facilities, such as network traffic statistics and file server monitoring, that you may really need; also, installation takes longer than that of most packages here.

McAfee Associates, 2710 Walsh Ave., #200, Santa Clara, CA 95051; 800-866-6585, 408-988-3832; fax 408-970-9727.

444 on reader service card

After you design an update or distribution procedure, you can allow users to set an update time or cancel the procedure. The user can decide to change the procedure and put the update in a different subdirectory or on another disk drive. You can also schedule updates based on time and date.

The NetRemote utility allows you to control any PC on the network remotely. You can also use NetRemote to launch

applications on the host PC.

BrightWorks offers one of the most powerful network virus programs of any product in this roundup. NetShield is an NLM that allows you to protect all of your files from virus infection; McAfee provides frequent updates to the NetShield virus database. But BrightWorks does not provide the level of network traffic monitoring and file-server statistics found in other products here. If you want to change your file server's configuration or monitor statistics, you will have to rely on NetWare utilities such as SYSCON.EXE and MONITOR.EXE.

This package offers powerful virus protection, network remote control, and excellent hardware and software inventory, but this version has its limitations. If you need to monitor applications on your client PCs or keep tabs on important network statistics, for example, you should consider another solution such as the Norton Administrator for Networks or the Frye suite.

Intel Corp.

• LANDesk Manager, Version 1.51

BY ROBERT L. MORRISON

In this, the fourth revision of LANDesk, Intel Corp. has a winner. LANDesk Manager, Version 1.51, installs easily and provides a full range of tools that help network managers identify and solve problems. The LANDesk utilities operate from a common Microsoft Windows interface but do not share an information database. (Intel says future versions probably will.)

At \$1,495 for one server, LANDesk Manager combines excellent network traffic reporting, highly informative server-performance monitoring, centralized alert-log reporting, and decent hardware and software inventory control and documentation. In addition, LANDesk provides virus protection, remote access, remote control, NetWare print-queue

SUITABILITY TO TASK

LANDesk Manager

HW and SW inventory	FAIR
Server Monitoring	EXCELLENT
Client control	GOOD
Network traffic	EXCELLENT
Application metering	N/A
Software distribution	N/A
Virus protection	FAIR
Integration	FAIR

■ The DMI from the DMTF: Just Another Standard?

By Leslie Wygant

The finalization of the Desktop Management Interface (DMI) was announced this past April by the Desktop Management Task Force (DMTF), a group formed to help the network management slice of the industry move toward ease of use and standardization. The DMTF aims to develop vendor-independent methods to manage hardware and software products. The DMI's success will depend on how well companies work together to build it in to their products.

The DMI is really a template for a management collection agent that gives network managers better ability to monitor and control desktops on the network. Currently, every desktop has a custom operating system, with different configurations. Under the DMI, desktop

configuration files would be uniform.

With the DMI, you will be able to scan the hardware on your network and put information in a standard database format, called a Management Information File (MIF). PCs, applications, and peripheral devices will automatically integrate into the system, giving their configuration and management information to the MIF.

The much-talked-about Plug and Play (PnP) technology, which is backed by many of the same vendors who are behind the DMTF, is similar to—but less extensive than—the DMI in its information-gathering capabilities. PnP is compatible with the DMI, but functions only at boot time. The DMI takes over where PnP stops, and PnP is limited to PCs based on Intel architecture. Moreover, the DMI is said to be

completely compatible with SNMP, but it is not restricted by SNMP's limits.

The DMI has three layers: service, management, and component. The service layer is the OS code (currently DOS, Microsoft Windows, and OS/2 are supported). The DMTF anticipates that IBM and Microsoft will include the DMI in future OS/2 and Chicago releases, respectively. The management interface applies to applications that use the service layer to manage the network. The component interface has all hardware and software applications, including PCs, servers, and printers.

The Software Developer's Kit (SDK), with sample MIF files, should be available this fall. It is geared toward vendors. The PC Systems Group announced its MIF in August; the Adapter Working Committee and the Printer Working Committee also plan to deliver MIFs in 1994. Software, server, and modem committees are in the works. For more information, contact the DMTF at 503-696-9300. □



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Network Management Software

PC MAGAZINE
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Products listed in review order

■ = YES □ = NO

See individual fact files for pricing.

Hardware and Software Inventory

Client operating systems supported

Inventories hardware

Inventories operating system

Inventories application software

Provides client configuration information

Tracks changes and notifies users of changes

Tracks changes and identifies version

Allows setup of license limits

Server Monitoring and Reporting

CPU utilization

Memory utilization

Disk and volume utilization

Log-ons and security

Provides configuration information

Network Traffic Monitoring

Monitors Ethernet packet statistics and errors

Monitors Ethernet utilization

Monitors IPX/SPX statistics

Monitors packets by MAC address

Allows setup of data-transfer threshold values

Application Metering

Meters applications on network drives

Meters applications on local drives

Alerts manager when license is exceeded

Enforces blocking when license is exceeded

Queues users when license is exceeded

Software Distribution

Method of distribution

Distributes to network servers

Distributes to local drives

Reports on distribution status

Automatically installs and updates

Triggers updates based on inventory information

.INI file management

McAfee Associates BrightWorks 1.1	Intel Corp. LANdesk Manager 1.51	Symantec Corp. LANtord 2.1	Cheyenne Software Inc. Monitrix for NetWare 3.0	Symantec Corp. Norton Administrator for Networks 1.0	Saber Software Corp. Saber LAN Workstation 5.0	Frye Computer Systems Inc. The Frye Utilities for Networks
DOS, Windows, Macintosh, OS/2	DOS, Windows, Macintosh	DOS, Windows	DOS, Windows, Macintosh, OS/2	DOS, Windows, Windows NT	DOS, Windows	DOS, Windows, Macintosh, OS/2
■	■	■	■	■	■	■
■	■	■	■	■	■	■
■	■	■	■	■	■	■
■	■	■	■	■	■	■
■	■ (on demand)	■	■	■ (notifies administrator only)	■	■
■	■ (on demand)	■	■	■	□	■
□	□	■	■	□	□	■ (via NEWS)
N/A	■	N/A	■	N/A	■	■
N/A	■	N/A	□	N/A	□	■
N/A	■	N/A	■	N/A	■	■
N/A	□	N/A	■	N/A	□	■
N/A	■	N/A	■	N/A	■	■
N/A	■	■	■	N/A	□	□
N/A	■	■	□	N/A	□	□
N/A	■	■	■	N/A	□	□
■	N/A	■	N/A	■	■	■
□	N/A	■	N/A	■	■	□
□	N/A	■	N/A	■	■	■
■	N/A	■	N/A	■	■	■
■	N/A	□	N/A	■	■	■
.EXE	N/A	N/A	N/A	.EXE	.EXE	.EXE or TSR
□	N/A	N/A	N/A	■	■	□
■	N/A	N/A	N/A	■	■	■
■	N/A	N/A	N/A	■	■	■
■	N/A	N/A	N/A	■	■	■
■	N/A	N/A	N/A	■	■	■
■	N/A	N/A	N/A	■	□	■
■	N/A	N/A	N/A	■	■	■

N/A—Not applicable. The product does not have this feature.

management, and client-to-client file-transfer capabilities. Although LANdesk currently lacks software distribution, the next release is scheduled to include it.

Like Saber LAN Workstation, LANdesk has a control panel that looks and feels like the Windows Program Manager, with modules represented as icons. It even has a set of system folders that contain some frequently used NetWare Utilities. You can add new icons for additional Windows utilities and applications and create new folders to organize the icons.

Alert Monitor is a centralized manager that activates an alarm when a thresh-



Intel's LANdesk combines all of its network management utilities together in a main window control panel that much resembles the Windows Program Manager.

old is reached. You can modify the thresholds and specify the type of notification, ranging from an audible signal to e-mail and pager calls.

A WORKSTATION THAT'S A WORKHORSE

With LANdesk, you can set up a separate traffic/inventory collection station. This reduces the amount of data that the administrator's console has to collect.

LANdesk really shines in monitoring network traffic. It displays real-time information on IPX, TCP/IP, DEC, SNA, and AppleTalk packets simultaneously and over different topologies. The Traffic



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THE PILOTS AT DELTA
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► SUMMARY OF FEATURES

ENDS

PC MAGAZINE
EDITORS' CHOICE

Products listed in review order

■ = YES □ = NO

Virus Protection

Server

■ (via optional NetShield)

■

■

■ (via optional Inoculan)

■

□

□

Client

■ (via optional NetShield)

■

■

■ (via optional Inoculan)

■

□

□

Notification and Alerting

Type of notification

E-mail, network message, pager

Dialog box, e-mail, printer, pager

E-mail, pager

Broadcast message, e-mail, fax, pager, printer, modem server, SNMP message

None

Broadcast message, console message, e-mail, pager

E-mail, fax, pager

Triggers alert when threshold is met

■

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■

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■

■

Reports

Predefined

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□

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User-definable

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Filtered

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Automation and Scheduling of Tasks

Client automation

■ (via scripting)

□

■

□

□

■

□

Server automation

□

□

□

□

□

■

■

Remote control of client PCs

■

□

■

□

■

■

□

NOS Support

LAN Manager 2.2

□

□

■ (under NetBIOS)

□

■

■

■

NetWare 2.x/3.x/4.x

□ ■ ■

□ ■ ■

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■ ■ ■

OS/2 LAN Server 3.0 Advanced

□

□

■ (under NetBIOS)

□

■

■

■

VINES 5.5

□

□

□

□

■

■

■

Windows NT Advanced Server 3.1

□

□

■ (under NetBIOS or IPX)

□

■

■

□

Management console platform

Windows

DOS, Windows

Windows, Windows for Workgroups

Windows, Windows for Workgroups

Windows, Windows for Workgroups, OS/2

Windows

DOS

Integration

Common user interface

■

■

■

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■

■

Common database

□

■

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■

Supports SNMP

□

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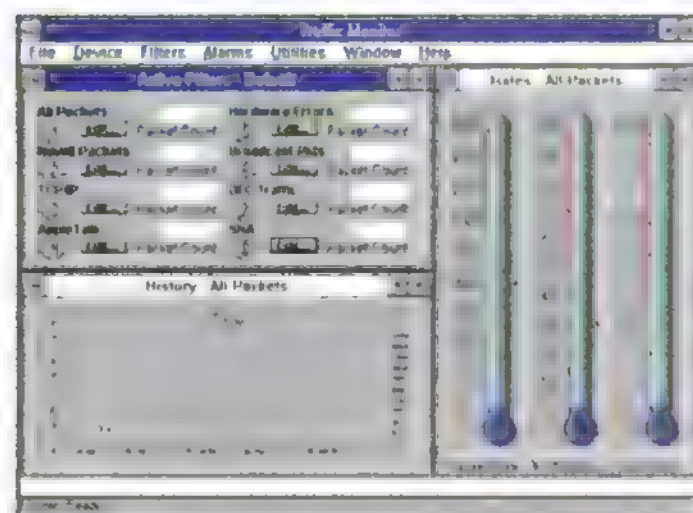
503-465-8484

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800-284-3793

Monitor graphically displays statistics about total packets, percentage of available bandwidth, and various error conditions. The Application Monitor, used with the Traffic Monitor, can trace packet traffic to a specific application.

The Server Monitor provides similar information to NetWare's MONITOR (in fact, if LANDesk Manager detects NMS on the server, it installs underneath NMS). The Server Monitor collects data on CPU utilization, file-system performance, volume and disk status, network error counts, and card status, among other things. It also monitors other types of



The traffic monitor module in LANDesk provides multiple simultaneous protocol packet counts for such protocols as TCP/IP and AppleTalk, in addition to NetWare's IPX.

servers, including print and communications servers. Server and Application Monitor data can be displayed in annotated graphs.

The built-in virus detector checks for more than 2,050 viruses and can be configured to scan and clean groups of files, directories, and network volumes. The virus scanner runs only under Windows, though, and thus cannot automatically scan a client PC at bootup.

The Inventory Manager, which supports DOS, Windows, and Macintosh OSs, gathers information on each client PC as it logs on to the network. The



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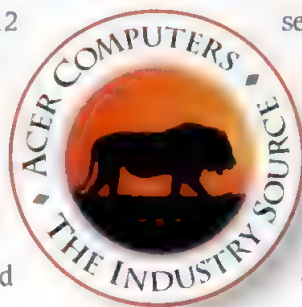
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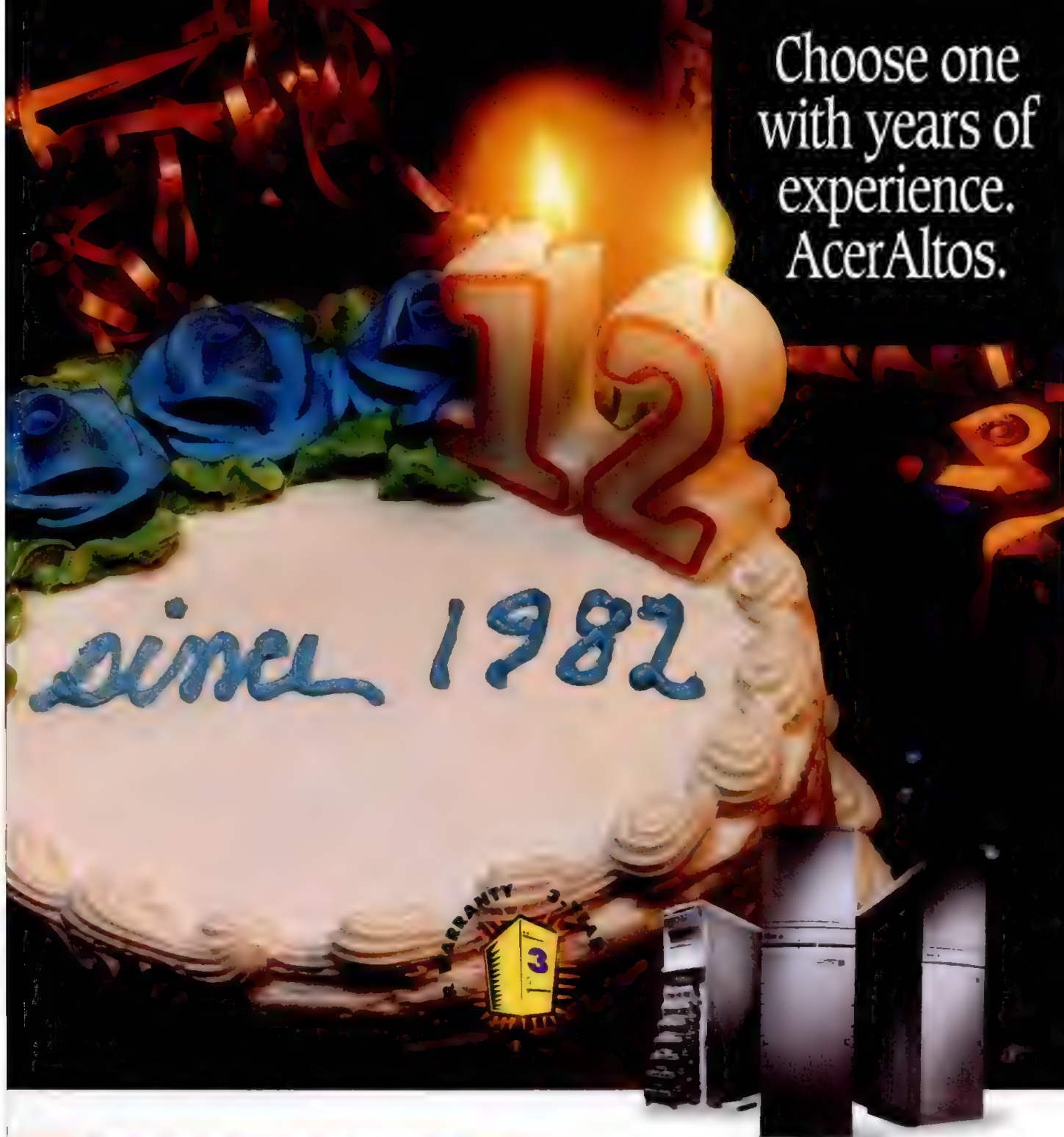
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■ Going Beyond Your NOS

By Steve Rigney

Do you wonder whether you really need to spend the money for network management products? The packages in the main article offer powerful features for monitoring and controlling your network, but what about the utilities that come built into your network operating system (NOS)?

Many NOSs, including Novell's NetWare 3.x and Microsoft Windows NT, provide tight security and remote access—not to mention free utilities for monitoring server utilization, network traffic and printing, and disk usage.

Security and usage auditing are two frequently used features of any NOS. Under NetWare, you can restrict users and groups from accessing certain files on the server. You can even use the accounting feature to bill people automatically for usage time. Windows NT doesn't do internal billing, but it does have an extensive audit utility. You can keep a history of all users that connect to a server and monitor any of a dozen categories of actions with files stored under the NTFS (NT File System).

Both NetWare and Windows NT provide powerful utilities to monitor server performance. The NetWare MONITOR NLM performs a real-time scan of more than 150 server resources,

including the CPU, hard disk, and memory; it also includes network traffic statistics. The drawbacks to the MONITOR utility are its character-based menu and the lack of any historical log or reporting capabilities.

Windows NT includes many tools similar to NetWare's, plus several more. The NT Performance Monitor uses graphs to show server and disk utilization, processor time, memory usage, and hundreds of other components. A history log is available for analysis. Though NetWare allows you to monitor and diagnose only your file servers, Windows NT provides detailed information on both servers and NT clients.

In terms of alerting, NetWare will notify the system administrator only when a file server is down, a network connection has broken, or a hard disk is saturated. Windows NT lets you set up alert thresholds for every component the administrator can monitor. Both products notify administrators only via network broadcast messages—not pagers, faxes, or e-mail.

Windows NT and NetWare include utilities that provide access to remote PCs across the LAN or via a dial-up connection. NetWare's RCONSOLE lets you remotely control servers through a LAN-to-LAN link; ACON-

SOLE lets you access remote servers over an asynchronous connection. Windows NT Remote Access Services lets you establish a remote-node connection to servers and networks over analog or ISDN lines.

Unlike NetWare, Windows NT also provides rudimentary hardware inventory and system information utilities. For example, you can determine the type of CPU, amount of RAM, and other basic hardware information. You can also monitor interrupts and DMA channels. NetWare provides information only on memory and hard disk usage. Windows NT logs all the information it gathers; NetWare provides a log only of server and transaction errors.

Novell also offers a collection of management utilities for NetWare called NetWare Management Services (NMS). NMS provides detailed server and network information. Microsoft's System Management Server (formerly referred to as Hermes) is scheduled to be available by the time this article is published and will include software distribution and updating and centralized server management.

Even the best NOSs don't provide software distribution or metering—but their basic tools give you a good handle on who's doing what on the network. □

scanning agent is a TSR that requires 6K of RAM, but Intel provides a supplemental log-on program that works with NetWare's LOGIN.EXE to solve the memory-relinquishing problem.

Using the Inventory Manager's query feature, you can access a list of client PCs that match certain criteria. But once you have the list, viewing inventory information is not as easy as it should be. Unlike Norton Administrator for Networks' inventory module, Inventory Manager does not categorize items. Instead, they are only classified as hardware, software, or user-supplied supplemental information.

LANDesk also provides remote control (over the network and via modem),

► FACT FILE

LANDesk Manager, Version 1.51

List price: 1 server, \$1,495; 4-server pack, \$4,495; 20-server pack, \$14,950. **In short:** Intel Corp. has come up with a powerful suite of utilities in LANDesk Manager, Version 1.51. The package installs easily and provides a full range of tools for identifying and solving problems. LANDesk Manager includes network traffic reporting, informative server-performance monitoring and centralized alert reporting. The power doesn't stop there—you also get virus protection, remote access, remote control, NetWare print-queue management, and client-to-client file transfer capabilities. You even get a chat facility.

Intel Corp., 5200 N.E. Elam Young Parkway, Hillsboro, OR 97124, 800-548-4725, 408-765-8080, fax, 800-458-6231

445 on reader service card

file transfer, and a chat program. Using network remote control, the LAN administrator can see a user's screen and take control of the system. The file-transfer package allows clients to exchange files without using network storage.

When any performance threshold is exceeded in a LANDesk module or when any condition occurs that causes NetWare to write to the system error log, an alert—that you define—is generated. LANDesk has four types of alerts: informational, normal, warning, and critical.

Several alarm conditions are preconfigured. These include available disk space running low, excessive number of packets transferred, and server overuti-

The squadron of 64-bit graphics accelerators from ATI — the GRAPHICS PRO TURBO, WINTURBO and GRAPHICS XPRESSION — has landed. Affordably priced from only \$179, they're attacking computers with rocket-like performance, laser sharp graphics and galactic true colors.

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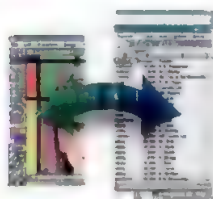


FlexDesk+

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*WinBench 4.0 and PC Bench 8.0 performance tests done on a Pentium 90MHz, 16MB RAM, 256K cache, 420 MB HD, using 2MB and 4MB PCI graphics cards. WinBench 4.0 at 1024x768/256 colors (large fonts) and 800x600 in 16.7M colors (small fonts) at 70Hz refresh rate.

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Perfecting the PC

CIRCLE 127 ON READER SERVICE CARD

Tools for Taking Stock

By Robert L. Morrison

It's 9:00 A.M., and you're the manager of a 40-node network. The vice president of operations just called and said he's discovered room in the budget for those upgrades after all—if you can generate a complete report on all the 386-based PCs by 11:00 for his meeting with the president. You grab your box of utility disks and start running, all the time wondering where you left the Pepto-Bismol and thinking, "There must be an easier way."

There is. Hardware and software inventory products track your LAN's hardware and software and save you from having to physically take inventory of each PC. This utility is the cornerstone of every suite of products in the main roundup here. Some inventory products also track the telecommunications equipment connected to the LAN, such as modems, CSU/DSUs, and MUXs. Other packages go beyond inventory management to include virus protection and diagnostic tools to help you find and fix common LAN problems.

LAN inventory programs typically have a collection module running on the server and a scanning module running on the client. The scanning module obtains the hardware and software configuration, and the collection module stores it in a central database. The collection module gathers a list of equipment, a directory of local drives on the client PCs, and the contents of configuration files; then it sends the information to the database.

Most of these programs can create special boot disks to collect information on standalone client PCs. Some packages can track other hardware platforms, such as Macintosh; others can work with different network operating systems and protocols. Most allow you to query the database for answers to management questions.

There are dozens of LAN inventory

programs on the market, and nearly all of them store the inventory information in a Btrieve- or dBASE-compatible database. We look at just a few inventory programs below. They let you customize the database by adding your own fields, such as serial numbers, vendor name, and phone number. They also have report writers that create quality reports and can export data to spreadsheet and word processor formats. If the native report generator does not suit your needs, a third-party reporting tool (such as Crystal Reports or R&R Report Writer) can do the job.

AUTOMATING INVENTORY

One package that can track a wide variety of client system platforms and NOSs is LANAuditor from Horizon Technology Inc. (800-828-3808). LANAuditor continually audits all client PCs for unauthorized changes in hardware and software and is completely transparent to the user. This program does not require a TSR loaded on the client, because all inventory updates are completed when the user logs on. It supports NetWare, LAN Manager, and VINES and is managed from a Windows-based console. LANAuditor can create many different reports, views, and queries on your equipment.

LANExam Node Agent, from Network Computing Inc. (800-736-3012), takes a different approach to tracking inventory. By monitoring IPX packets sent throughout the network, it identifies any device that responds, including routers, clients, servers, and print servers. The program works with HP OpenView to graphically display the LAN as a map. For easy access to

the inventory database, you simply double-click on a server or client icon, saving you from having to weed through large amounts of information.

In addition to inventory tracking, CheckIt LAN from Advanced Systems Research (800-448-5734) has the ability to run a complete battery of hardware diagnostics on all of your PCs.

These diagnostics cover such critical areas as the system board, memory, hard disks, floppy disks, and video subsystems. CheckIt LAN runs a virus scan, hardware diagnostics, and a software audit. A unique feature of CheckIt LAN is that it does all of its work after the user logs out for the day.

Most of these LAN inventory programs can help track software licenses in addition to hardware information. While they do not perform true software

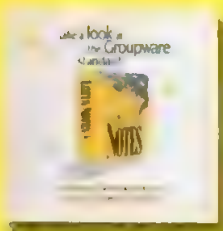
metering and distribution, they can tell you which software packages each user has installed and compare that list to an actual inventory of licensed copies. You specify the number of licenses your company owns when you set up the package.

Although not every LAN manager needs (or can afford) a full suite of network management products, an inventory management tool should be a part of every network manager's arsenal. These products pay for themselves almost immediately when you consider the time it takes to inventory all your network hardware and software manually. Couple this with the added features that come with many of these products and the only decision you're left with is which product is right for you. □

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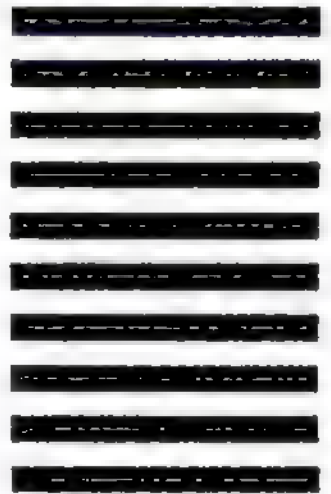
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lization. The monitoring and alert functions integrate with Novell's NMS and SynOptic's Optivity for NMS.

The Intel documentation is well organized. The Problem Solving Guide helps diagnose and solve common network problems, such as detecting excess network traffic, evaluating a client PC's performance on the network, and determining the best time to do server backups.

If you want a comprehensive LAN management tool that helps you solve day-to-day problems—one with a slick interface and powerful monitoring tools—LAN-Desk Manager 1.51 is the suite for you.

Symantec Corp.

• LANlord, Version 2.1

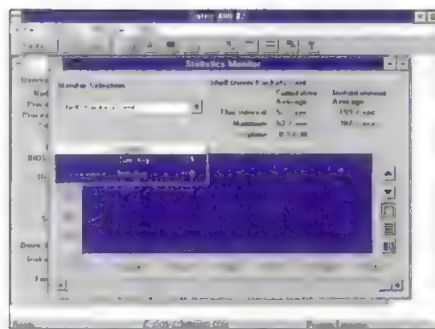
BY GREGORY C. ALWANG

Now owned and marketed by Symantec Corp., Central Point's LANlord boasts innovative, real-time network-traffic monitoring and good performance, but at a cost for smaller networks: It requires a dedicated OS/2 server. For the \$2,499 50-user license, though, Version 2.1 packs a host of other features, including hardware and software inventory, application metering, remote control, virus protection, and notification and alerting.

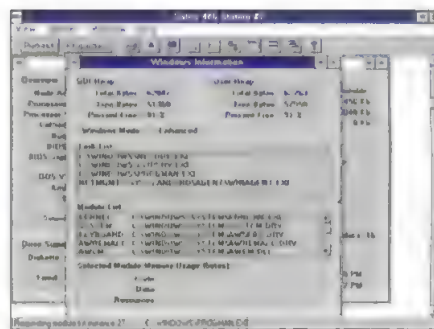
LANlord requires a dedicated OS/2 system running a network requester program, such as Novell's NetWare Requester for OS/2. Although perhaps too steep a price for a smaller network, an OS/2 server could take the load off the NetWare servers in a large, multiserver installation. It could also continue to gather information if the NetWare servers go down. (Symantec says Version 2.5 will offer NLM support.)

We installed LANlord and generated its Btrieve databases without a hitch. Once you install it, you can virtually forget about it. Everything also went smoothly when we installed the LANlord Manager module on Microsoft Windows 3.1 or Windows for Workgroups (WfWG) 3.11 clients with NETX drivers.

When we installed it with WfWG using VLM drivers, however, we encountered frequent errors and lockups. A Symantec



Symantec's LANlord gives you both real-time and historical information on network traffic.



LANlord includes a behind-the-scenes, real-time view of your Windows resources.

engineer told us there is a known incompatibility with certain Windows software under the WfWG-VLM combination. Rather than wait for a VLM update from Novell or Microsoft, Symantec has written its own patch to correct the problem. We reverted to the NETX drivers. (Symantec says Version 2.5 will address the problem.)

LANlord's true strength lies in its real-time monitoring capabilities. A management information base (MIB) that contains inventory and configuration information and system files is maintained locally on each PC and sent to LANlord only when information changes. This makes inventory scans fast and reduces network traffic.

When configuration or inventory information changes on a client, it is automatically sent to the LANlord Manager database. The administrator does not have to wait until a client reboots or logs in again to find out about changes. Inventory works with DOS and Windows.

The reports for inventory detail or summary information are plentiful but ordinary at best, and little or no formatting control is offered. Software inventory reports require that you use a query builder to generate a query record based on

vendors, products, file names, paths, or workstation IDs. Unfortunately, the query builder is not intuitive: You must specify criteria for a report, rather than ask for general information. Sample queries would also have helped. Fortunately, report data can be exported to dBASE, Paradox, or ASCII CSV format.

LANlord monitors an abundance of client information in real time, covering IPX and SPX packets, the network shell, asynchronous events, the LAN driver, NetBIOS, and LAN Manager statistics. LANlord can monitor IPX and NetBIOS traffic simultaneously, but it does not track server-based statistics and utilization. The package even tracks Windows resource usage at the client system level, which is rare in this field. This allows an administrator to monitor and troubleshoot potential Windows GPF and memory issues by setting alerts based on Windows GDI and user heap values.

The package's application metering allows you to view activity, real-time and past, in line-graph format. You can set

LANlord traps to generate alerts and block users from access when license limits are met or exceeded by setting LANlord traps. Traps or alerts can be sent to MS Mail or other MAPI-compliant mail systems, MHS Mail, cc:Mail, pagers, or wireless data receivers.

In addition to license tracking, traps

► FACT FILE

LANlord, Version 2.1

List price: For 50 users, \$2,499. **In short:** Symantec Corp.'s LANlord, Version 2.1, provides powerful, real-time monitoring of workstations; application metering; and an abundance of network traffic statistics. But it does not monitor servers, and for smaller installations, the required OS/2 server is overkill. This product is probably more suited to large, multiserver networks, in which an OS/2 server would be good for dedicated network monitoring. A new, NLM-based version and bug fixes make the upcoming LANlord, Version 2.5, worth waiting for.

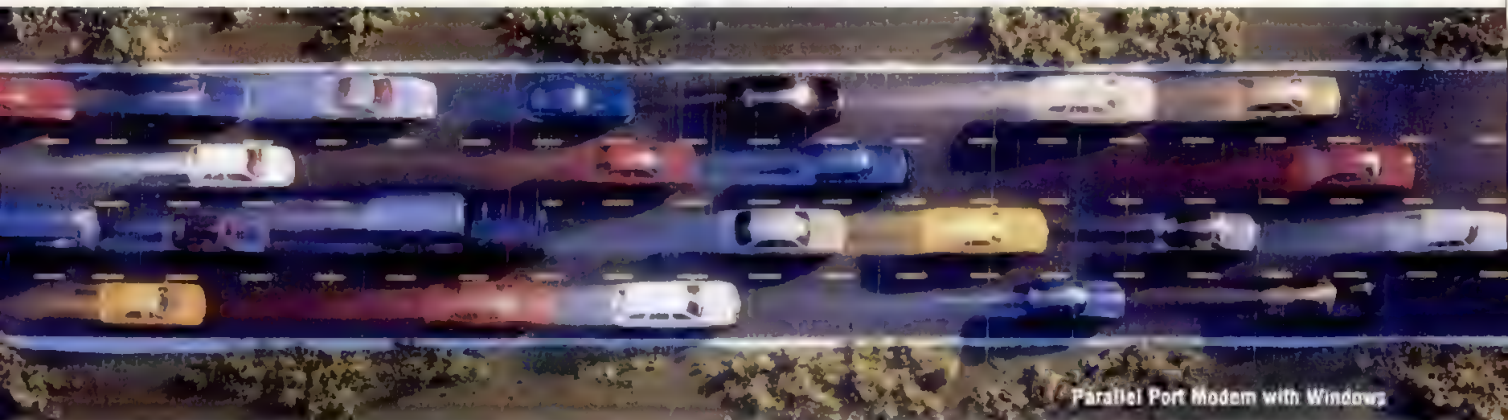
Symantec Corp., Central Point Division, 15220 NW Greenbrier Pkwy., Suite 150, Beaverton, OR 97006; 800-964-6896, 503-690-8088; fax, 503-690-8083.

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Serial Port Modem with Windows

WHAT HAPPENS TO WINDOWS DATA WITH AN ORDINARY MODEM.

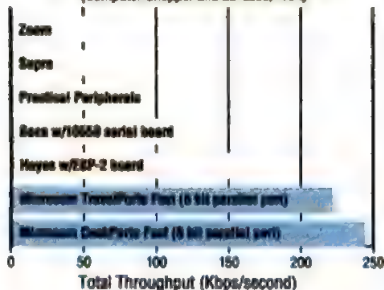


Parallel Port Modem with Windows

WHAT HAPPENS TO WINDOWS DATA WITH A MICROCOM MODEM.

Modem Performance in Windows

(Computer Shopper and ZD Labs, 7/94)



The problem with ordinary modems is the serial port bottleneck. At high speeds, Windows data slams on the brakes as it tries to squeeze through your modem's **serial port—which can only transfer data one bit at a time**. Results: slower performance, frequent loss of data and higher phone charges.

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CIRCLE 862 ON READER SERVICE CARD

■ It's More than Just Metering

By Mary Carleton

Not every network manager needs a Swiss-Army-knife-style package of utilities. If you can leave the physical details to others and concentrate on user and usage aspects, think about a standalone application-metering package. We took a look at Express System's Express Meter 2.2, Funk Software's AppMeter 1.1, and McAfee Associates' BrightWorks' SiteMeter 4.2. Only Express Meter will run on both NetWare and non-NetWare networks.

Using an application-metering package can be the single most cost-productive thing you do for your network. Using it to balance the distribution of applications on a multiserver network will increase throughput without adding hardware.

You can avoid needless costs for extra licenses and discover unused licenses to use as coin for competitive upgrades to licenses that you do need. You also protect your company's liability. And when you need more hardware or more licenses, the metering package can provide you with documentation to justify your request.

Metering packages are passive or active. The three here are active. Passive meters observe network and application traffic, compiling and reporting their observations. They may warn users about exceeding licenses, but they do not enforce limits. Active packages may be used passively, but they also can enforce licensing by making would-be users wait until a licensed application is available.

Most packages meter only what they can see. This normally includes all server-based but not client-based software.

Software suites (such as Microsoft Works) pose another challenge. Should the entire suite be treated as a single package or can the applications be broken out? The answer varies from vendor to vendor. The default is to treat a suite as one license; additional licenses are also available for the individual included applications, such as the word processor.

These packages offer multiple ways to handle exceeded licenses. If you are simply auditing your network, then you can observe and tally license usages without alerting users. The next step up is to warn users that licenses have been exceeded, but still take no action. The third, and default, level is to inform users that licenses have been exceeded and to place users into a queue until a licensed application

becomes available. Optional notification can be given to current users that others are waiting.

The fourth alternative, used by simpler packages, is to simply lock the prospective user out, leaving it up to them to try again later. All packages have provisions for VIP users who are never to be locked out of given applications—even if licenses have been exceeded.

PROACTIVE APPLICATION MANAGEMENT

Express Meter is the most complete package of the three (206-728-8300). It uses a combination of server-based executables and client TSRs. It handles suites and waiting lists and produces minimum usage reports. One of the nicest extras is a prebuilt library of popular applications, so the manager usually needs only to plug in the num-

ber of available licenses and maybe the cost per license.

Being able to use Microsoft Windows' browse feature when registering applications is also nice. Express Meter took special care to educate administrators about the best ways of using and interpreting gathered information to help make the most of this package. Express Meter's administrative program is Windows-based.

Funk Software's AppMeter (800-828-4146) takes a unique approach, but it can meter only applications for which there is a single network copy that everyone uses. For each registered application, a stub file is created on the server that in turn executes the desired application. The actual application is hidden. This allows individual treatment of applications through command-line options fed to the stub file. It also allows the creation of aliases for an application.

Aliases let you split your licenses among different groups to allow for preferential access, such as allocating 5 of 20 licenses to the 5 users in accounting and the remaining 15 licenses to the other 95 users of the network. AppMeter, which is DOS-based, is as functional as the other packages—but it is more confusing for the administrator to set up and use.

McAfee's SiteMeter, formerly known as SiteLock, is a standalone subset of the BrightWorks network management package (908-530-0440). SiteMeter, which needs no TSRs on the client station, provides strong network security as well as license enforcement. An optional TSR can be used with SiteMeter to restrict network access to only those with that TSR loaded.

Provision is made to except certain workstations (such as Macs) that cannot run IBM software. SiteMeter is also Windows-based, and it includes the much-touted report writer Crystal Reports. □

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Network Management

can be set on any of the statistical categories monitored by LANlord. These include IPX or SPX traffic, or even virus detection by the scanning agent on a client PC.

Any of the client PCs' system files (including AUTOEXEC.BAT, CONFIG.SYS, and WIN.INI) can be updated from the LANlord Manager's PC without remote-control software. Environment variables also can be edited "live." Finally, one option allows you to reboot a client PC immediately, after a delay, or after user confirmation. We used these remote capabilities frequently during testing.

LANlord includes Carbon Copy for Windows (CCW) for remote access via modem to client PCs. Although you can configure LANlord to distribute CCW to client hard disks automatically, the installation option did not work. (Symantec says this also is corrected in Version 2.5.)

A powerful network management product, LANlord is geared towards large networks. Yet it does not offer server-based monitoring or software distribution and is not as intuitive as other packages here. With NLM support and fixes to Version 2.1 bugs in the upcoming version, LANlord could be a contender.

Cheyenne Software Inc.

• Monitrix for NetWare, Version 3.0

BY GREGORY C. ALWANG

Here's a package with solid network management features and a well-integrated interface from a tried-and-true network utility vendor for a bargain-basement price. At \$495 for 50 nodes, Version 3.0 of Cheyenne Software's Monitrix includes hardware and software inventory, network traffic statistics, server monitoring, notification and alerting, and a powerful reporting module. It also has a database shared across its inventory, monitoring, reporting, and alerting functions.

Monitrix installs as an NLM on a NetWare server, and management files install on a Microsoft Windows-equipped workstation. You can set up as many Monitrix Manager workstations as you need. Monitrix

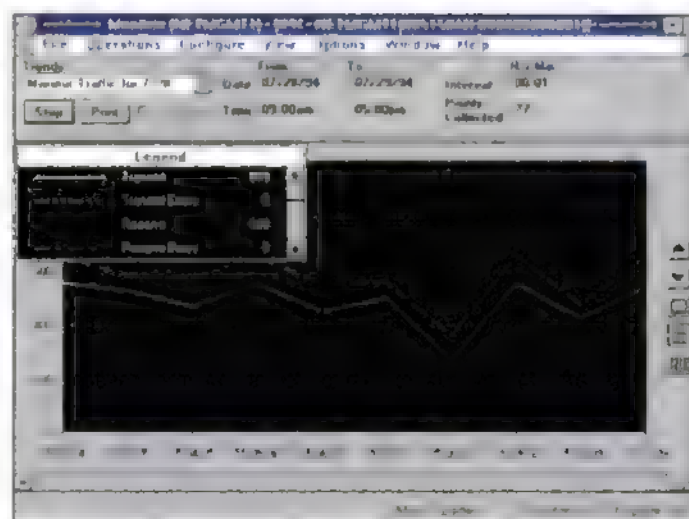
fully supports multi-server environments: The licensing agreement allows you to distribute Monitrix to an unlimited number of secondary servers connected to your LAN or WAN. The secondary servers feed inventory and configuration information to the primary server.

After installing Monitrix, you must configure various defaults, such as the frequency with which software scanning is to be performed and with which client system files are to be backed up. Next, you place an entry in the log-on script or modify a client's startup to run the inventory collection agent.

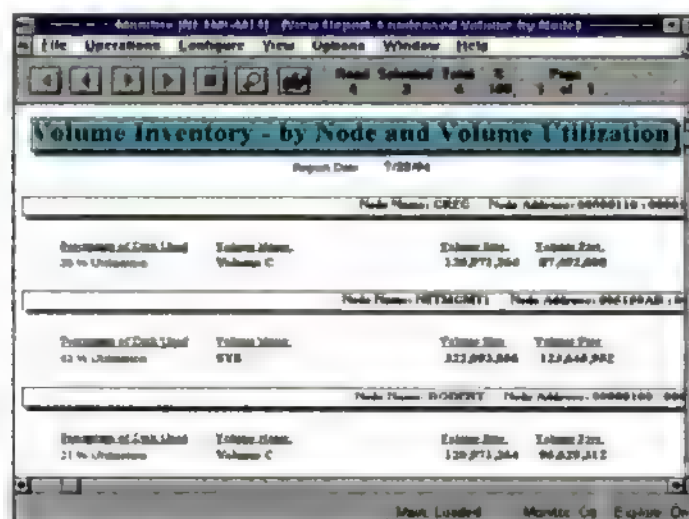
Monitrix supports DOS, Windows, Macintosh, and OS/2 and provides separate agents for each. The non-TSR agents collect hardware and software information from various clients as they boot and report it to the Monitrix server.

Like Norton Administrator for Networks, Monitrix has a Quick Access Toolbar with buttons for the three primary options: inventory, monitor, and report. It takes advantage of its new Windows interface to offer good integration of the utilities, and it provides up to ten multiple views of the data. It keeps a shared database for inventory, monitoring, reporting, and alerting.

Monitrix's inventory information, although well organized, is not quite as broad as that of The Frye Utilities or Norton Administrator for Networks. The Node Browser, which resembles the Windows File Manager, is used to select, sort, and group PCs for viewing inventory or



Cheyenne's Monitrix uses colorful trend graphs to monitor packet-transmission statistics.



Monitrix uses Crystal Reports to generate presentation-quality reports.

monitoring. Nodes can be grouped by location, department, network segment, name (from inventory), network address, and machine type.

Application software designated for inventory is stored in Monitrix's Title Database, which comes populated with some 1,200 software titles. Entries in this database can be marked as shareware (available to client PCs), blacklisted (triggers an alarm if it is detected anywhere on the network), or proprietary (not for use on local client PCs).

For reports, Monitrix includes Crystal Reports, an easy-to-use, powerful report writer. More than 30 predefined reports are available from the Monitrix report menu. In addition, Crystal Reports can be run outside of Monitrix to create detailed, custom reports based on Monitrix's Btrieve data. Its features include borders, lines, fonts, graphics, boxes, and calculated fields.

True to its name, Monitrix excels at monitoring network and server statistics.

▶ FACT FILE

Monitrix for NetWare, Version 3.0

List price: Up to 50 nodes, \$495; up to 250 nodes, add \$195; up to 2,000 nodes, add \$495. **In short:** Along with its excellent server and workstation statistics monitoring and alerting capabilities, Monitrix for NetWare, Version 3.0, offers a well-integrated interface across its utilities. The software installs as an NLM and supports a wide range of clients, including OS/2 and Macintosh systems. Monitrix borrows many good characteristics from its quality sibling products, ARCServe and InocuLAN; it offers powerful network management features at a great price.

Cheyenne Software Inc., 3 Expressway Plaza, Roslyn Heights, NY 11577; 800-243-9462, 516-484-5110; fax, 516-484-3446

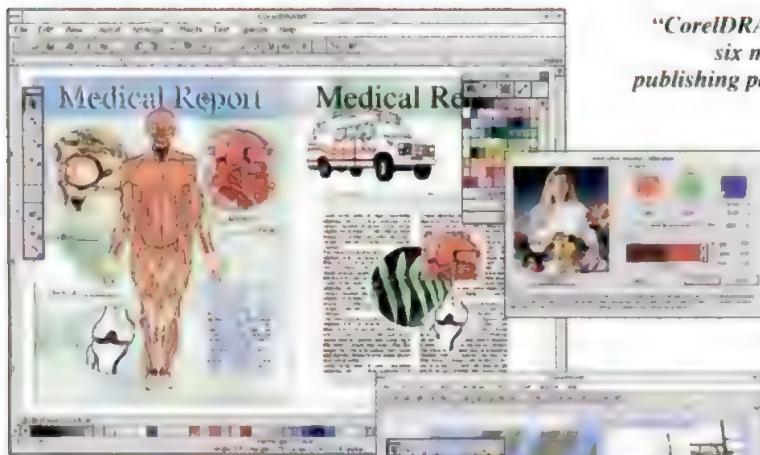
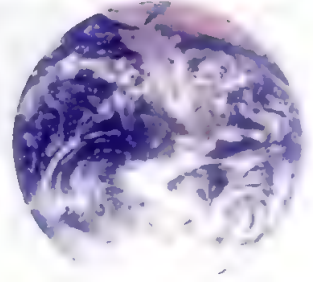
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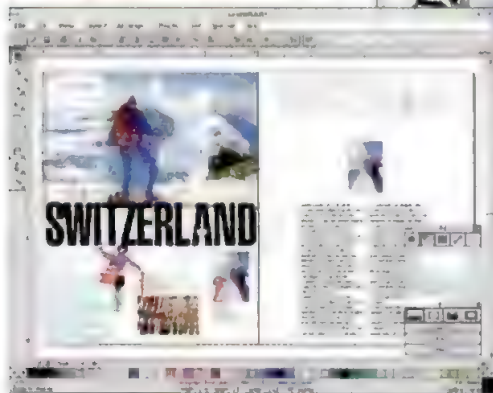
PC Praxis, June 1994-GERMANY

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CIRCLE 322 ON READER SERVICE CARD

Upgrades by Sleight of Hand

By Chul Sung Kim

Say goodbye to the bad old days of walking from cube to cube with a stack of disks in hand at version upgrade time. Today's slick applications should arrive at your desk by snazzier means.

Electronic software distribution (ESD) is the generic-sounding name of a fairly narrowly defined technique for getting new or updated software onto the hard disks of network clients and servers. With ESD, a central distribution server actively downloads software packages to target systems—usually clients. ESD agents residing on target systems process the packages to duplicate conventional installation by disk effectively.

The software to be distributed can be as small and simple as a network driver or as large and complex as a new version of Microsoft Windows. Often the client agent will need to place files in multiple subdirectories and tweak various configuration files. Many ESD products can also undo installations automatically.

ESD functionality is often bundled with other network management tools. Four packages in our roundup include this facility: BrightWorks, the Norton Administrator for Networks, Saber LAN Workstation, and The Frye Utilities for Networks. One major advantage of these integrated packages is that the ESD utility can work with the hardware and software inventory utility. This facilitates selecting target clients for particular installations. These packages may be all you need, and they're affordable.

Larger, distributed enterprise networks may need more comprehensive—and more costly—solutions, perhaps devoted exclusively to software distribution. Enterprise-oriented ESD solutions commonly use a tiered, or staged, approach to software distri-

bution management. Here's a look at a few standalone solutions.

GIVING SOFTWARE ITS DUE

In Novell's NetWare Navigator (800-453-1267), a central distribution server downloads the software (with a distribution list and processing instructions) to any number of staging servers throughout the enterprise. The staging servers then forward the software and instructions to designated clients. This approach helps balance network traffic and ease the load on the corporate backbone.

NetWare Navigator is PC-based. Servers running NetWare 3.x/4.x and the Navigator NLM support IPX-connected DOS, Windows, and OS/2 clients. Support for non-IPX networks is provided by the addition of Novell's DOS LAN Distributor—as long as the network supports file sharing. Navigator can install NetWare upgrades on servers as well.

By contrast, the core components of Legent's Distribulink (800-676-5468) and TelePartner International's Synchrony (800-935-3270) run on mainframe or Unix hosts. Such solutions, which often rely on TCP/IP as the transmission protocol and support Unix workstations as well as PC clients, are well-suited to diverse legacy environments. IBM's NetView Distribution Manager family (800-426-3333) straddles the divide: Versions of its server component are available for the MVS mainframe operating system, AIX (IBM's Unix implementation), OS/2, and NetWare.

The methods by which a software package is transformed into a working application also differ between, and

even within, ESD products. NetView DM, which uses one of three techniques (depending on the target OS) illustrates the point. DOS and OS/2 applications are handled by their own installer utilities. Windows applications are installed by duplicating the configuration of a model client that the manager installs conventionally. Finally, AIX clients use Installp control files that instruct the client agent where to put the software and how to modify configuration files.

With electronic software distribution features, you can use a server to download and install software for every user on your network.

A NEW (OLD) PLAYER

Soon, every ESD vendor will face stiff competition from a major new player in the field: Microsoft. Its upcoming Systems Management Server (SMS) addresses software distribution, among other management issues, and combines some of the best ideas from other ESD solutions with a few of its own.

Incorporating a Microsoft SQL Server database for enterprise-wide inventory tracking, SMS will bring exceptional power and versatility to the task of selecting target ESD clients. Like other ESD systems, SMS uses a staged distribution structure—but in its case, any number of staging levels can be set up to reflect the organizational structure.

SMS will support the various Microsoft network operating systems as well as NetWare. (SMS servers and the management console run Windows NT; otherwise, the network can be all Novell.) Supported clients at release will include DOS, Windows, and OS/2, with Macs to follow. □

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CIRCLE 935 ON READER SERVICE CARD

Network Management

You can establish dates and times of a trend period and view graphic displays of each monitored item during that time. Threshold values can also be set for each item to generate alerts and custom messages if a threshold is met. Trends can be based on server monitoring or statistics for triggering alerts.

The Monitrix documentation contains several example scenarios to set up trends for monitoring different situations. These examples are a boon to any network administrator still learning the ropes. (Note, too, that an index card in the package, directed to Novell NMS 2.0B users, announces a DLL update available on CompuServe that corrects some integration problems with NMS.)

At the server level, Monitrix tracks CPU utilization, system resource distribution (open files, receive buffers, pending disk requests, active processes, and active connections), and IPX/SPX transmissions. The powerful ALERT.NLM, also found in Cheyenne's InocuLAN and ARCServe, is used for notification. InocuLAN provides excellent virus protection and can be used with Monitrix to provide a more complete network management package.

A multitude of thresholds can be set for network traffic and server statistics. Alerts can go to fax numbers (with a custom fax header), network print queues, modem servers, network broadcasts, MHS addresses, pagers, remote servers, and SNMP managers.

With this latest release, Monitrix has matured into a solid product with powerful monitoring and alerting capabilities and a full-featured, integrated report writer. It lacks application metering, software distribution, and remote control of clients, but with its new pricing structure, it is one of the most affordable choices here.

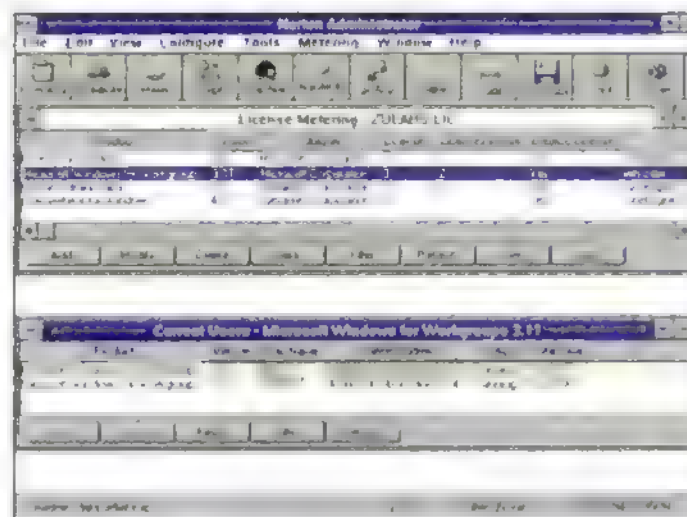
Symantec Corp.

• Norton Administrator for Networks, Version 1.0

BY GREGORY C. ALWANG

Affordable and versatile, the Norton Administrator for Networks (NAN) is also tightly integrated with other standalone Norton Network Series products that are sold separately. Only \$65 per node (for a 5-user license; price ranges to \$44 per node for a 1,000-user license) buys you hardware and software inventory, software distribu-

tion, application metering, reporting, and a powerful scripting module. What you won't get with NAN, however, are two important network management functions: server monitoring and network traffic statistics.



Norton Administrator for Networks includes a toolbar to start any Network Series product.

NAN runs on Microsoft LAN Manager and Windows NT Advanced Server, NetWare, OS/2 LAN Server, VINES, and Pathworks. We tested it over NetWare with Norton Antivirus for NetWare (\$995) and pcAnywhere (\$199).

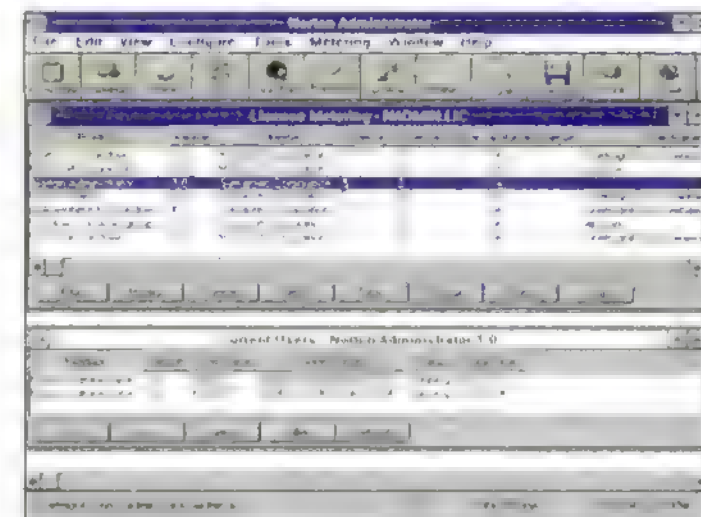
As with other Symantec products, installation is a breeze. We had NAN up and running in under 30 minutes. All companion products must be installed separately—except for Norton pcAnywhere for Windows and Antivirus, which require an addition to NADMIN.INI, they add themselves automatically to NAN Console's toolbar.

NAN uses a series of agents to collect information. The application-metering agent is the only DOS TSR, occupying 4.8K. During installation, you can choose to update the system log-on script with the required load statements or manually add a line to call the supplied TSRLOAD.BAT file.

Each time a user boots a PC or logs on to the network (depending on where you load the agents), a detailed inventory is collected. Unlike Central Point's LANlord, which collects inventory information in real time, NAN collects inventory information only when the agent executes the utility. From the NAN Console, you can control the amount of time a user waits while the agent is gathering inventory data. The agent picks up where it left off the next time it runs.

NAN's inventory utility works with DOS, Windows, and Windows NT systems.

Inventory items are grouped into logical main categories and subcategories. It is easy to locate and select items, providing even more detail about each client. Inventory reports are ad hoc in nature and allow you to build your own columnar reports consisting of any of the hundreds of inventory fields. We merely pointed-and-clicked on fields to include them in a report and double-clicked on a field header



Norton Administrator for Networks meters application licenses in real time.

to sort by that field. You can also apply filters to any combination of inventory fields. Fonts, shading, and grid lines can be controlled. Fields can be summarized in six formats.

The network manager can specify which Windows and DOS application licenses to meter on client hard disks or on network volumes. A real-time license-metering log tracks how many licenses are available, how many are in use and by whom, and who last used each licensed application. When a license limit is met, custom messages are displayed on the client screen; users can wait in the queue or try again later. You can also meter apps by workgroup.

NAN's Distribution Tool creates distribution jobs on client PCs for displaying messages, copying and deleting files, launching applications, and editing .INI and text files. Jobs can be saved and have a preset list of recipients, a series of actions, and a scheduled time to run. Distribution logs track which recipients ran the job and when, as well as any problems that occurred. NAN also offers Script-

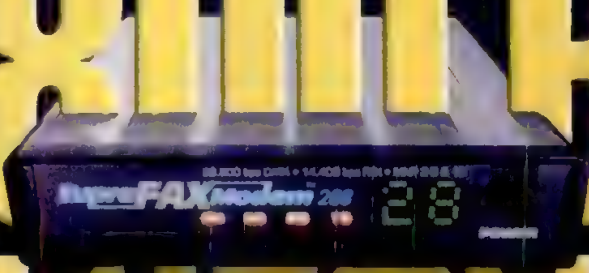
SUITABILITY TO TASK

Norton Administrator for Networks

HW and SW inventory	GOOD
Server monitoring	N/A
Client control	GOOD
Network traffic	N/A
Application metering	GOOD
Software distribution	EXCELLENT
Virus protection	EXCELLENT
Integration	GOOD

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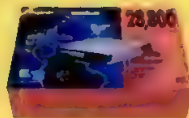


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1st Place — PC Computing, "Great bundle with bargain price—our winner was a favorite with testers." June 1994.

★★★★ — MACWORLD, "Supra is paving the way for life in the fast lane." August 1994.

CIRCLE 183 ON READER SERVICE CARD

Maker—a robust scripting language that creates compiled BASIC-like routines and supports Windows API routines.

Symantec's pcAnywhere combines with NAN to provide remote access. You can use pcAnywhere as a troubleshooting tool for all PCs on the LAN or WAN and remote PCs with modems.

Norton Antivirus, the only NLM component in the suite, is accessible from the toolbar. Like Cheyenne's InocuLAN, Antivirus provides real-time virus scanning of all server-based files—even Mac files. Antivirus also supports scheduled, unattended scans and controls the amount of server utilization for a scan. Virus detection alerts can be broadcast or sent to MHS addresses or pagers. Antivirus does not scan local hard disks.

For added protection and security, NAN works with both Norton Utilities Administrator (\$350) and Norton DiskLock Administrator (\$1,161). The Utilities allow you to run the venerable Norton Disk Doctor on client hard disks and create rescue-disk information. Rescue disks can be generated conveniently from the NAN Console. In addition to providing added security and encryption, DiskLock lets you centrally monitor and audit client access and security violations.

NAN is a robust network management package. Part of its lure lies in its integration with companion products. Although NAN is impressive, it is somewhat limited by its lack of server and traffic monitoring.

► FACT FILE

Norton Administrator for Networks, Version 1.0

List price: Ranges from \$65 per node (for 5 users) to \$44 per node (for 1,000 users). **In short:** This affordable package works across a healthy range of network operating systems. Norton Administrator for Networks (NAN) offers good utilities, although no network traffic statistics or server monitoring, and integrates well with other Norton utilities, including pcAnywhere, Norton Antivirus, and Norton Utilities. With its slick, unobtrusive interface and the backing of several award-winning add-ons, this is a package to consider.

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 800-441-7234, 408-253-9600; fax, 408-252-4694.

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Saber Software Corp.

● Saber LAN Workstation, Version 5.0

BY STEVE RIGNEY

Saber Software Corp.'s suite of network management products provides reliable, inexpensive monitoring of your local or enterprise network. Overall, Saber LAN

Workstation, Version 5.0, is extremely strong on application metering (which is well-integrated with inventory), with a few features no other products here offer. But it is not as robust as some on hardware and software inventory or server and traffic monitoring.

The suite includes Saber LAN Workstation, Saber Server Manager, and Saber Enterprise Applications Manager (SEAM). The \$199 Saber LAN Workstation, Saber's flagship program, includes well-integrated application metering and software distribution and updating, as well as hardware and software inventory, a Microsoft Windows and DOS menu utility, and network remote control. SEAM, an add-on to a LAN client PC, expands application metering across multiple file servers. SEAM lists for \$695; for another \$695, you can purchase Saber Server Manager, which allows you to monitor and tune your NetWare servers.

With Saber LAN Workstation, you'll need to plan on spending a few days installing and configuring. The Saber LAN Workstation package includes five large manuals and requires approximately 21MB of disk space. Saber

► FACT FILE

Saber LAN Workstation, Version 5.0

List price: Saber LAN Workstation, \$199, nodes, \$49 each; Saber Enterprise Application Manager (SEAM), Version 1.1, \$695; Saber Server Manager, Version 1.0, \$695. **In short:** Saber's network management solution has powerful and well-integrated application metering and excellent reporting tools. But a few other packages here have stronger client hardware and software inventory, and Saber LAN Workstation is short on network traffic and server monitoring. SaberBASIC, the scripting language, is powerful and flexible—but it requires a working knowledge of BASIC.

Saber Software Corp., 5944 Luther Lane, Suite 1007, Dallas, TX 75225, 800-338-8754, 214-361-8086, fax, 214-361-1882.

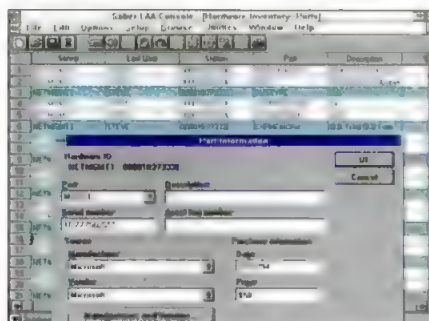
449 on reader service card

LAN Workstation also requires you to edit your client and server configuration files manually.

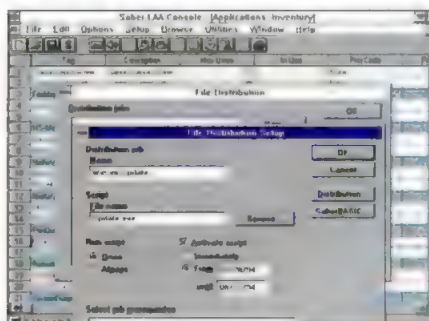
You can configure the inventory utility to perform a scan every time a user turns on a PC or at prescheduled times of day. Unfortunately, Saber LAN Workstation cannot produce an inventory of your file server hardware—only of the network clients. The utility that performs the hardware and software inventory works with most major network operating systems, including NetWare and VINES.

In addition, the inventory utility is closely integrated with the application metering utility, which checks apps on both the file server and client PCs. It uses information from the software inventory scan to add metered applications to the Saber database. In fact, you cannot meter an application until it has been scanned and added to the Saber database.

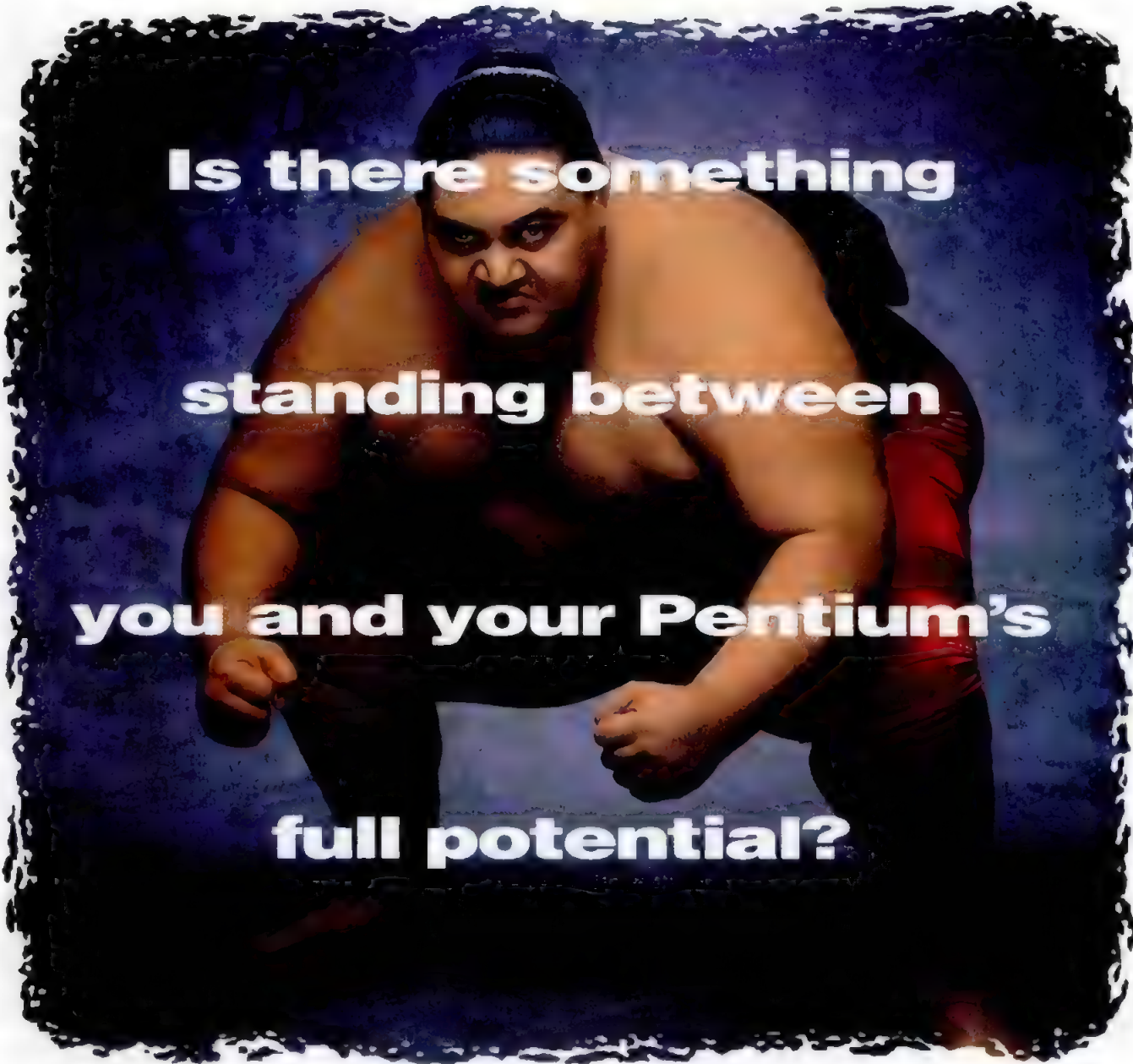
Saber offers four application-metering modes. Metering-off disables metering for all applications. Audit-



Saber LAN Workstation's inventory utility lets you add information to your database.



Saber LAN Workstation lets you distribute and update software to any or all workstations.



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CIRCLE 117 ON READER SERVICE CARD

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options feature built-in networking* and SCSI-2 capabilities for an instant desktop configuration~with ports for your full-sized monitor and keyboard. The SmartStation also adds expansion slots and bays,



a spare battery charger and motorized docking.

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hard to make a wrong decision. If not impossible.

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~TO THE IMPOSSIBLE.

Network Management

only mode does not restrict users from accessing a licensed application, but it keeps a log of all software usage. This is ideal if you want to monitor usage before you invest in more user licenses. Nonsecure mode allows you to run applications that have not been metered, and secure mode requires you to meter every application before you can access the program.

If you add SEAM, you get the ability to meter applications over multiple file

Saber excels in application metering, but Saber LAN Workstation's server and traffic monitoring capabilities are not as robust.

servers. SEAM runs as an NLM and includes such features as a queue for users waiting on a metered application and the ability to share licenses between servers. No other product in this review allows you to share licenses between multiple servers on a LAN or WAN.

Saber LAN Workstation offers a powerful scripting language, SaberBASIC, to automate software updates and distribution. This DOS-based language is similar to Microsoft BASIC and lets you create programs for distributing files, launching applications, and running reports. You can also create scripts to launch an application on remote network clients automatically. Unlike The Frye Utilities, Saber LAN Workstation will not let you create a script for automatically loading and unloading NLMs on your server.

Although SaberBASIC is more powerful than the scripting languages from Frye and McAfee, Saber does not provide predefined scripts. Moreover, if you are unfamiliar with BASIC, you'll need to learn it before you can start creating even the most rudimentary scripts. Saber does offer predefined scripts over its BBS.

The Server Manager lets you fine-tune your NetWare server. It provides an easy-to-use menu for changing your server parameters and monitoring other server in-

formation, such as I/O, disk usage, and cache statistics. Server Manager takes the raw data from NetWare and presents it in an easy-to-understand graph or report.

All of Saber's utilities offer excellent reporting tools. You can add comments and notes to your inventory information and create detailed customized reports. For example, you could create a report showing how many hard disks you have, their total capacities, manufacturers, and warranty information. You can also create a report on application usage for individual departments or by application.

Saber bundles the network portion of Ocean Isle Software's ReachOut Remote Control program for accessing network clients. You can use ReachOut to take control of a user's PC to run applications or make configuration changes.

Saber LAN Workstation, Server Manager, and SEAM provide a wealth of information and control over your network applications. Saber does not provide the same amount of network traffic and server information as other products, such as Frye's. But if one of your principal goals is powerful application metering for your network, Saber is the way to go.

Frye Computer Systems Inc.

EDITORS' CHOICE The Frye Utilities for Networks

BY STEVE RIGNEY

If you need to control and monitor a medium-size to large network from a single location and you want to automate your net-

work tasks, The Frye Utilities for Networks (FUN) are for you. Frye Computer Systems offers its utilities separately so you

can add as you go, and they are extremely well integrated—a solid solution when they're all together.

The suite includes hardware and software inventory, software distribution and update, application metering, NetWare server management, traffic monitoring, client tracking, and error notification.

A couple of things could give some pause. First, by the time you add several modules together, FUN costs more than other network utilities such as Norton Administrator for Net-

works and Saber LAN Workstation. The FUN modules range in price from \$149 for the Node Tracker to \$1,495 for the Software Update and Distribution System (SUDS) Wide Area Network Distribution Module. But the tight integration among individual modules and the abundance of features make The Frye Utilities for Networks a bargain, especially for medium-size to large networks.

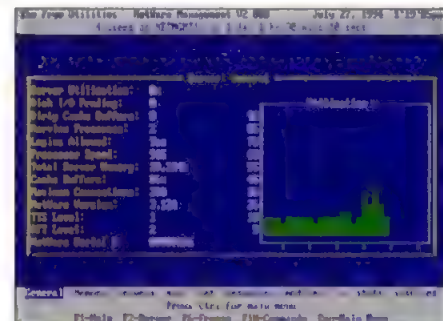
In addition to the price tag, the DOS-based menu format may cause some network managers to balk. These are well-designed, easy-to-use interfaces, but some may prefer only Microsoft Windows. Frye is in the process of porting several of the FUN modules to Windows.

The LAN Directory module produces an inventory of all your network hardware and software. This program uses a utility to scan every network client's hardware and software every time a user connects to the network or turns on the PC. LAN Directory works with several differ-

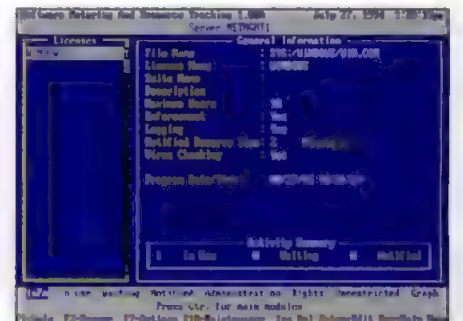
SUITABILITY TO TASK

The Frye Utilities for Networks

HW and SW inventory	GOOD
Server monitoring	EXCELLENT
Client control	N/A
Network traffic	FAIR
Application metering	FAIR
Software distribution	EXCELLENT
Virus protection	N/A
Integration	GOOD



The Frye Utilities for Networks offers you important information about your file server.



The Frye Utilities for Networks enables you to control access to file-server applications.

ent network operating systems, including NetWare, VINES, and Microsoft LAN Manager. In addition to inventorying the hardware on DOS and Windows systems, LAN Directory also inventories more than 150 Macintosh hardware items.

For software inventory, the LAN Directory recognizes some 6,000 applications. It provides the program name, vendor, and a description of the program, which you can also use to create detailed reports. The LAN Directory is integrated with the Early Warning System, and you can configure it to alert the network administrator if any hardware or software changes occur.

The Software Metering and Resource Tracking (SMART) module allows you to control access to applications based on user licenses. Unlike other metering programs (such as Saber LAN Workstation's) that meter software on the both the file server and the client PCs, SMART currently meters applications only on the file server. (By the time you read this, Frye is scheduled to release a new version of SMART that meters server and clients.)

You can use the Node Tracker to monitor your network traffic, including the number and status of the IPX packets moving across the cable. Other packages in this roundup, such as McAfee's BrightWorks, do not offer the ability to monitor packets and collisions on the network. You can also use Node Tracker to create a map of all the nodes on your network and monitor them individually.

Frye offers two Software Update Dis-

tribution System (SUDS) packages: SUDS for a single network with one or two servers and the SUDS WAN for enterprise networks. You can use either of Frye's SUDS to distribute and update files and programs on every PC in your network. You can also collect and edit files and then send them back to the network clients.

The SUDS model is based on activities Frye calls Procedures, Criteria, and Actions. A Procedure is the name of the entire software update or distribution you design. The Criteria is a list of which client PCs will be updated, and the Actions are the tasks themselves.

Frye includes several predefined scripts; for example, one provides for updating every 486 PC with a new Windows video driver. Although Frye's scripting language is not as powerful and versatile as other products, such as SaberBASIC, it is faster and easier to use.

The Frye NetWare Management utilities allow you to perform every task found in NetWare programs such as MONITOR, SYSCON, FCONSOLE, and PCONSOLE—from a single menu. NetWare Management provides information about your NetWare file server and allows you to create user groups and print queues and change log-on scripts. The NetWare Management utilities integrate with the NetWare Early Warning System to alert the network manager if the file server has problems, such as insufficient disk space or memory.

The NetWare Console Commander (NCC) allows you to schedule tasks on the file server. For example, you could schedule your tape backup NLMs to load at 2:00 A.M., perform a backup, and unload in the morning. This arrangement is great for freeing up memory used by unnecessary NLMs. NCC is also strongly integrated with the Early Warning System: If something goes wrong, the Early Warning System can stop or start crucial activities.

This review provides only a glimpse into the features offered in The Frye Utilities for Networks modules. Frye offers utilities for the majority of procedures you need to manage your network. And they are standalone applications, so you can add them as needed. The FUN suite is a first-rate solution. □

VB Power



ISBN: 1-56276-073-4
Price: \$34.95

This innovative guide by Dan Appleman turns Visual Basic programmers into power users by illuminating the tools of the Windows Application Program Interface (API). Includes a time-saving disk that contains source code from the examples in the text, plus a specially designed dynamic link library (DLL).



Available at fine bookstores, or call
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▶ FACT FILE

The Frye Utilities for Networks

List price: NetWare Management 2.0, \$495; NetWare Early Warning System 1.51, \$495; LAN Directory 1.5, \$495; NetWare Console Commander 1.0, \$395; Software Update and Distribution System 1.5, \$995; Node Tracker 1.0, \$149; SUDS Wide Area Network Distribution Module 1.0, \$1,495; Alert Interface Manager for NMS 1.0, \$895. Software Metering and Resource Tracking 1.0: for 100 users, \$495; for 250 users, \$995; for 1,000 users, \$3,795. **In short:** Buying several Frye modules may seem pricey, but their depth and integration make the line a bargain—and you can buy modules as you need them. Frye continues to implement a DOS-based interface, but it is well designed.

Frye Computer Systems Inc., 19 Temple Place, Boston, MA 02111; 800-234-3793, 617-451-5400; fax, 617-451-6711.

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- MaxVIEW
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- Quick Access
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Looking for a low-cost, high quality video solution for your PC? MGA Impression Plus gives you the option of either software video acceleration through Microsoft DCI support, or hardware video acceleration with MGA Video XL for the smoothest, photo-realistic video playback at ultra-high resolutions.

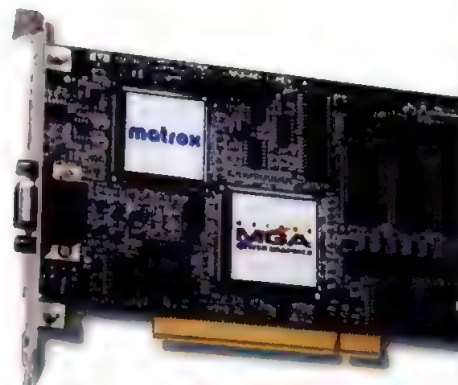
- 30 frames per second with Microsoft DCI software video playback
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WinBench 4.0 scores based on 4 MB PCI boards using a PentiumPS-60, 16 MB RAM, 200MHz math. ©1994 All rights reserved. Matrox, Matrox MGA, Matrox G200, Matrox Impact Multimedia are registered trademarks of Matrox Electronic Systems Ltd.

Notes:
(1) Price for the MGA Impression Plus w/2 MB VRAM, PCI local bus.
(2) Speed performance based on in-house testing of a 4 MB PCI board using 200-MHz WinBench 4.0 on a PentiumPS-90, 16 MB RAM, 256KB cache, 1024 x 768 x 256 colors.
(3) Requires 4 MB of VRAM.

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Network Edition



The latest network
products
and management
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First Looks

► DOCUMENT MANAGEMENT

Digging Through Your Data

Tired of sifting through endless numbers of documents? One of these four packages should help you cut to the quick.

By John Garriss

Did you ever try to locate a two month-old document? First, you wade through endless directory paths, examine a plethora of cryptic DOS-based filenames, and perform wildcard searches. When you're done with that, then you still need to scan dozens of files to find the right one.

Now a new document management system (DMS), Visual Recall, from XSoft (a division of Xerox Corp.), hopes to revolutionize DMSs with new tools for sifting through the thousands of possible documents. Are these new search capabilities enough to catapult

Visual Recall to an Editors' Choice? We compared Visual Recall with upgraded versions of three products previously tested (See "The Painful Transition," June 29, 1993): Mezzanine, Version 3.10c with Document Manager, Version 1.0, from Saros Corp.; PC DOCS Open, Version 2.0, from PC DOCS, and SoftSolutions, Version 4.0, from Novell.

We tested each product on a NetWare 3.12 network and DOS/Windows workstations loaded with Microsoft Office 4.2, WordPerfect 6.0, and Lotus 1-2-3, Release 5. The three upgrades showed considerable improvement over the earlier versions. XSoft's entry was powerful.

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Remote management made easy, NE22.

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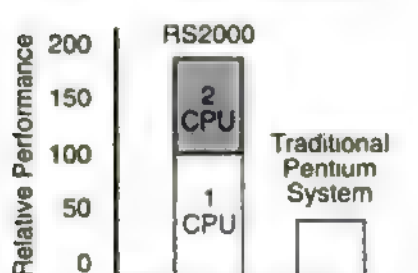
simultaneously. Bandwidths will increase too, since
multiple applications can be executed at the same
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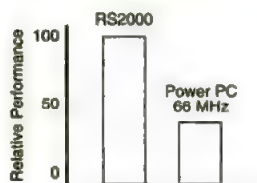


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*Multiprocessor benchmark run on the RISCstation 2000 (single and multiprocessor) and a Compaq ProLiant 66 MHz Pentium-based system with 32-bit Picture Publisher 4.0 performing a Gaussian blur on a full screen.

**Microsoft Visual C++ Version 2.0 Development System for MIPS.

***Emulation benchmark run with 16-bit Word Perfect 5.1 on RISCstation (multiprocessor) and a 66 MHz Power Mac.

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Document Management

CONTINUED FROM NE1

but the best combination of power, features, and ease of use is found in PC DOCS Open.

THE SEARCH CONTINUES

While companies invest in powerful database systems to manage their accounts, valuable information is often left scattered through a collection of word processing and spreadsheet documents. DMSs tackle this problem: They take all the documents floating around your network and provide a means of organized access. The end result is less wasted work, more collaboration, and higher productivity.

Some of these products' facilities will be addressed in the upcoming Microsoft Windows 95 (previously code-named Chicago). Windows 95 will ease document management by supporting long filenames and using OLE information as search criteria to locate files. The operating system will also ship with a document browser that allows users to view files quickly without having to launch the application that created them.

Another class of products, known as image-management software, manages bit-mapped images such as scanned images or faxes. Unlike DMSs, these packages cannot search on document text. Users can search only for manually entered keywords. And although these images can be browsed and printed, they cannot be edited in place. If you have massive stores of scanned images or computerized faxes, you should probably look into image-management software, but the DMSs reviewed here often bundle an imaging package, such as Watermark Imaging, to handle small-scale image management.

FINDERS KEEPERS

The ability to create meaningful document filenames is one major benefit of a DMS, but they can do much more. DMSs find documents faster and more easily than DOS or File Manager do. They can search on document text or profile information (author, project, and security privileges). And they have browsers that let you view



• PC DOCS Open, Version 2.0

PC DOCS knows document management. Last year, we gave the DOS-based PC DOCS, Version 4.1, our Editors' Choice award for its exceptional ease of use and its powerful document-management engine ("The Painful Transition," June 29, 1993).

PC DOCS Open, Version 2.0, builds upon that standard of excellence: It supports back-end SQL databases such as Oracle7 Server and Microsoft SQL Server, and it easily integrates with Microsoft Windows. Creating document profiles, performing profile and full-text searches, and organizing your documents are all done quickly and easily with PC DOCS Open. In short, making the transition to document management can be difficult, but PC DOCS Open simplifies the task.

The competition has gotten better, too. The optional add-on modules for Novell's SoftSolutions, Version 4.0, such as the Server Enhancement Module and the Document Desktop, provide greater security for document data, increased performance, and a clean user interface.

documents quickly without loading the application used to create them. These systems also provide version control. When someone checks a document out from the system to make changes, the DMS will track those changes.

When choosing a DMS, network administrators and end users will focus on different issues. Administrative issues revolve largely around security and the size of an installation—the number of users and documents to be managed as well as the number of remote sites. The user, on the other hand, will consider the ease of use of the client interface. Consider both of these issues before choosing a DMS. Visual Recall offers the most elegant interface here, but it is not designed for an enterprise environment. Geared primarily for NetWare LANs of up to 50 users, Visual Recall is simple to configure, and it requires little database

In Document Manager, Version 1.0, Saros Corp. offers an improved interface to its enterprise document-management engine, Mezzanine, Version 3.10c. This powerful interface handles all of your enterprisewide needs. Unfortunately, at times we found it difficult to use.

Visual Recall, from XSoft, features the best search and visualization mechanisms of all the packages reviewed here. Geared for NetWare-based workgroups, Visual Recall puts you in command of all your documents by presenting data in effective, graphical ways. On the other hand, Visual Recall's biggest shortcoming is its lack of integration with popular Windows applications, making it harder to check documents in and out of the document management system.

or networking expertise.

If you are using document management software in an enterprise environment, consider packages with client/server designs. These systems provide more secure access to database information. Mezzanine, PC DOCS Open, and SoftSolutions are all geared to handle large installations, but their methods differ. PC DOCS Open is the only package in this roundup that hooks into multiple SQL databases, such as Oracle7 Server and Microsoft SQL Server. Saros, on the other hand, uses its SQL-based Mezzanine server, which is based on Sybase SQL Server. And SoftSolutions uses a proprietary database with an optional server-based processing module. Client/server architectures such as these are especially helpful for implementing document management over wide-area links; limiting network bandwidth often

brings about considerable performance boosts.

Sites with remote users or more than 50 local users will want to focus on preserving on-line storage and security. As the number of files increase and the number of versions of those files grow, you won't be able to store them all on your server, so you need a way of migrating them to off-line storage. DMSs do this by tagging old documents to be archived. Although the document data moves off-line, the profile information is retained so users can still perform queries on archived documents.

While all of these DMSs provide some level of security, we found that you can often bypass the security features using DOS or File Manager. Saros offers the tightest security mechanisms; users have no way of accessing files or database information except through the DMS. With the other packages we needed to correlate network-level security manually with our DMS security settings. And with Visual Recall and the basic SoftSolutions package, we were able to delete document profile information directly from the DOS prompt, although SoftSolutions provides an optional prod-

uct to prevent this unauthorized access.

Once administrative issues are out of the way, look at the client interfaces that let users access the DMS. Expect some resistance at first: Checking in documents can feel a bit like putting your valuable data into a black box. And instead of wandering through File Manager to find the information desired, you ask the DMS system explicitly for all your documents.

Some packages make the transition from File Manager to a DMS easier. All the packages except Visual Recall automatically hook into popular Windows applications. They override the standard File/Open and File/Save dialog boxes, providing direct access to the DMS. With Visual Recall, or with unsupported applications (applications other than word processors and spreadsheets), the document check-in process is manual; save the document first, and then check it in using the DMS user interface.

These products also offer centralized programs that let users perform all their daily work. The PC DOCS Open interface, for example, allows users to create folders to store frequently used documents. And they can create icons to launch their favorite applications or to

perform searches automatically on profiles or document text. SoftSolutions provides an optional program, called the Document Desktop, which provides the same features and is also easy to use. Saros's Document Manager is also intuitive, but it feels more like File Manager.

The most visually impressive interface, however, came from XSoft. While the other products present documents in a simple list, Visual Recall also let us view hierarchical relationships among documents based on profile information. We could also view our documents on a computer-generated, 3-D grid to compare document groups and examine the chronological history of a document set.

Finally, there are other features to look at, including multiple platform support on the client, report-generating tools, and hooks into e-mail packages. Unfortunately, none of these packages reviewed here offer Macintosh support, and only SoftSolutions offers native DOS support. Look first for a database engine that can scale to your long-term needs, as well as an intuitive user interface.

The products on the following pages are fast and efficient options for helping users locate, retrieve, and display their documents. Pick the right one, and you'll spend less time wading through mounds of files and more time doing what you enjoy: your job.

Saros Corp.

● Mezzanine/ Document Manager

If you are looking for a powerful back-end document-management engine to handle all of your enterprisewide needs, Saros Corp.'s Mezzanine, Version 3.10c, may be the one for you. Its client interface, Document Manager, Version 1.0, is clearly presented but is still a bit rough around the edges.

The Saros line revolves around its SQL-based document server, Mezzanine, which can be loaded either on an OS/2 or Unix workstation. When configuring Mezzanine, we created catalog servers, which contained profile indexes for all of our users' documents, as well as shelf servers, which are directory paths—on

Continues on page NE6

Suitability to Task: Document Management Systems

We evaluate these document management systems in four key areas.

Installation and configuration A good document management system (DMS) will lead you clearly through the different stages of installation, from configuring the back-end database to integrating client software with all of its supported applications. We look at the ease of creating templates for document profiles. We also want utilities that let us import large quantities of documents easily.

Creation and manipulation

Creating documents should be easy, and this largely depends on the interface. We look at the interface in general: how easy it is to do quick searches and the general desktop environment that is created. We also look for hooks to override File/Open and File/Save dialog boxes for most popular Windows applications. Furthermore, we evaluate the ability to

create nestable folders, search icons, and document icons with the DMS front end. We also look for provisions to let users access documents from remote locations.

Document retrieval Here we evaluate the package's search tools. With document management software, we want to be able to perform both

profile and full-text searches on documents located on any server on the network. We look for Boolean logic to let us combine multiple search criteria, and we give extra points for intelligent searching mechanisms, such as proximity searches or thesaurus-based searches.

Ongoing maintenance Once the DMS is installed, we assess administrative issues. First, we look at network security. We want tight integration with the NOS to ensure data integrity. We then look at the DMS's backup and archiving mechanisms, as well as its ability to create reports.

SUITABILITY TO TASK

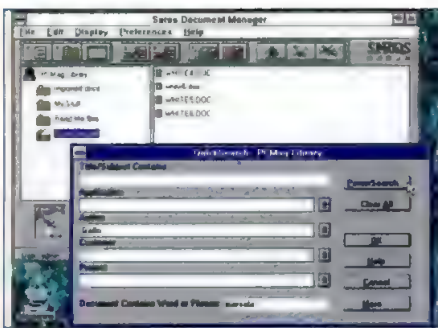
Product Name	
Installation and configuration	EXCELLENT
Creation and manipulation	GOOD
Document retrieval	FAIR
Ongoing maintenance	POOR

Document Management

CONTINUED FROM NE5

either local or network drives—containing actual document files.

We used the OS/2 version of Mezzanine, which was fairly easy to install but difficult to configure. During installation, we simply answered a few questions, and the install program did the rest. We then installed the configuration program, FileShare, which let us create catalog and shelf servers, assign security rights, and



FILE FINDER: Document Manager shows containers and their associated files.

import our existing document set into the system. Although the program was functionally adequate, we had difficulty figuring out all the steps.

Mezzanine features a scalable architecture, which can grow as the network load increases. We configured multiple machines to service a single document library. An overloaded server can off-load work to another Mezzanine server.

We then loaded Document Manager from a Windows workstation. The program is generally well organized and intuitive. SoftSolutions and PC DOCS Open are more like Program Manager; Visual Recall is less of a desktop environment. Document Manager, however, arranges documents somewhat as File Manager does: Click on a library or container on the left, and the associated files appear on the right. After you select a document, you can double-click any of the clearly labeled buttons to browse or

edit the document. You can also perform searches on document profiles or text. Furthermore, Document Manager provides hooks into all the Windows-based applications we installed except for Lotus 1-2-3, Release 5.

SUITABILITY TO TASK

Mezzanine/ Document Manager

Installation and configuration	FAIR
Creation and manipulation	FAIR
Document retrieval	GOOD
Ongoing maintenance	GOOD

We found a few rough spots with the initial release, however. Sometimes, when we tried to browse or edit a document, nothing would happen when we clicked on the buttons. Also, if we closed a document by selecting the Close option in the File menu, Document Manager would prompt us to save the document, but if we just double-clicked on the document's Close box, then the document would go away and all our work would be lost.

You don't have to buy Document Manager when you buy Mezzanine. You can buy a Software Development Kit (SDK), provided by Saros, to create customized applications that hook into

Continues on page NE8

KING AMONG PEERS

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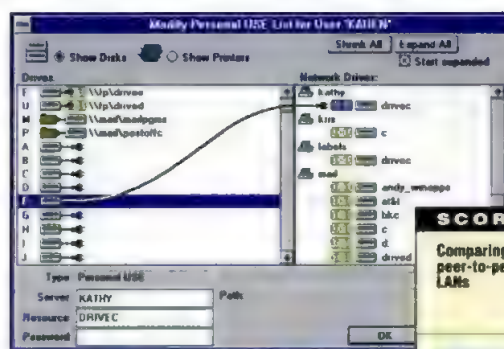
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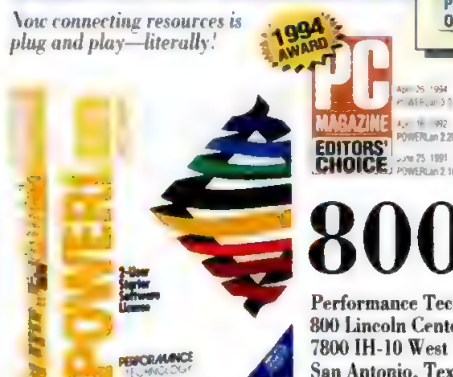


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"POWERLan's combination of ease of use, solid performance, and strong management features will appeal to many small to medium-sized sites looking to connect their stand-alone computers."

PC Week
February 7, 1994

SCOREBOARD				
Comparing peer-to-peer LANs	PCWEEK LABS REVIEW	Artisoft Inc. Simply LANtastic 5.1	Microsoft Corp. Windows for Workgroups 3.11	Novell Inc. Personal NetWare 1.1
PCWEEK LABS Overall score		3.2	3.5	3.5
				4.0



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Document Management

CONTINUED FROM NE6

Mezzanine directly. The SDK supports Mac, OS/2, Unix, and Windows clients.

We found Mezzanine to be a powerful back-end document server. But the first version of Document Manager, though it has some nice features, needs fine-tuning.

► **Mezzanine, Version 3.10c; Document Manager, Version 1.0.** List price: *Both packages, \$495 per seat; Mezzanine only, \$330 per seat.* Saros Corp., 700 Plaza Center, 10900 NE Eighth St., Bellevue, WA 98004; 800-827-2767; fax, 206-462-0879.

Circle 965 on reader service card

NETWORK EDITION EDITORS' CHOICE

PC DOCS Inc.

•PC DOCS Open

Sporting such new features as a user-friendly client interface, open connectivity to multiple SQL database engines, and convenient administration tools, PC DOCS Open, Version 2.0, is a blessing both to use and to administer. It's an excellent choice for handling your document-management needs, whether at the workgroup or enterprise level.

We got the system up and running in just a couple of hours. First, we installed Microsoft SQL Server on a Microsoft Windows NT workstation and followed the PC DOCS documentation to create a PC DOCS database. PC DOCS is the only package here that works with a number of third-party SQL databases, such as SQL Server and Oracle7 Server to index document profiles. For new installations, PC DOCS recommends Microsoft SQL Server for Windows NT.

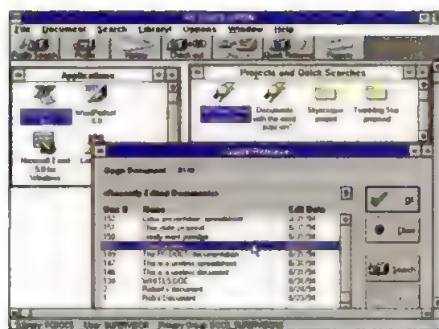
Once we created the database, we loaded the PC DOCS software without a glitch. PC DOCS contains a number of Windows-based administration tools to help migrate existing data into the system

SUITABILITY TO TASK

PC DOCS Open

Installation and configuration	EXCELLENT
Creation and manipulation	EXCELLENT
Document retrieval	GOOD
Ongoing maintenance	GOOD

and to integrate Windows apps with PC DOCS. The configuration tools were easy to use and included a utility called the DOCS Designer, which lets admin-



RE-SEARCH: PC DOCS Open stores often-used searches as icons.

istrators create customized document profiles. DOCS Designer let us specify exactly how document profile templates would look; we could add or delete fields, change fonts, and edit the positioning of all fields.

PC DOCS' interface, the best here, provides a convenient workplace for users to launch applications, perform searches, and check documents in or out. It let us search on any profile field or on full text. We also performed full-text-phrase or proximity searches, but PC DOCS warns of additional storage requirements in the database when it is configured to support those search types.

The interface let us store often-used searches as icons and create folders.

PC DOCS, like SoftSolutions, integrated seamlessly into all of the Windows applications we loaded. For applications not specifically supported, however, PC DOCS monitors a directory we specified while the application was running. When we quit the application, PC DOCS checked the folder to see if any new documents had been created, and it automatically prompted us to check them in.

PC DOCS is the only reviewed system that features an optional package for mobile users: PC DOCS Mobile. For \$20 to \$50 per user, mobile users can check out documents from the network and use the PC DOCS desktop to manipulate those documents. When a document is returned to the network, the user can check it back in to the PC DOCS system.

Currently, PC DOCS offers only a Windows client; DOS and Macintosh clients are expected in early 1995. Overall, PC DOCS Open is a solid package, providing both a user-friendly interface and a powerful database engine.

► **PC DOCS Open, Version 2.0.** List
Continues on page NE10

■ Document Management Standards: Securing Your Investment

Document management systems (DMSs) organize your work, but there are problems. Vendors must write customized hooks into applications one by one, with solutions often less than ideal. Perhaps more important, different DMSs that use proprietary interfaces can't talk to each other.

To address these issues, DMS vendors gathered to develop an initiative called ODMA (Open Document Management Architecture), which establishes a standardized way for off-the-shelf applications to hook into various DMSs. With ODMA, users will have a consistent way to open, close, and save documents directly from their applications, without worrying about the underlying DMS.

To complement ODMA, two more

standards emerged to ease communication between client document-management software and back-end document engines. The Shamrock Document Management Coalition, spearheaded by Saros Corp. and IBM, is developing a standardized API called ELS (Enterprise Library Services), which is essentially middleware. Applications using ELS can ask to scan profiles or check out documents, and DMSs hooked into ELS can then process that request.

Another standard, Document Enabled Networking (DEN), offers services like ELS's. The DEN initiative led by Xerox and Novell is now integrated with NetWare, but there are plans to move DEN to other OSs and to offer ELS interoperability. □

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Document Management

CONTINUED FROM NE8

price: Server, \$495; client, \$299. Bundled with Sybase SQL Server or Oracle7 Server: server, \$695; client, \$395. PC DOCS Inc., 124 Marriott Dr., Tallahassee, FL 32301; 904-942-3627; fax, 904-656-5559.

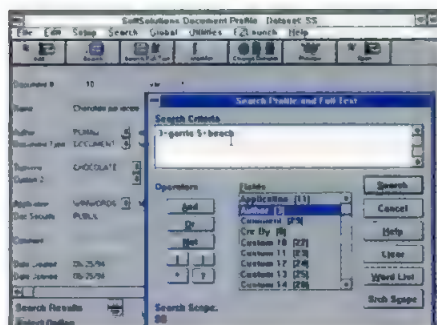
Circle 966 on reader service card

Novell Inc.

SoftSolutions

SoftSolutions, Version 4.0, provides major enhancements over its last release: It's got a new document desktop and it's now part of Novell. The basic package provides a strong set of document management services. It also includes optional modules that offer better performance, increased security, and a friendlier client interface.

We installed SoftSolutions on the network from a Microsoft Windows workstation. It's the only system here that supports a DOS package as well. During installation, SoftSolutions creates a pro-



DUAL SEARCHING: SoftSolutions lets you search using profile data or full text.

proprietary database, which it uses to index documents. You have two configuration options: Use File Services, in which client workstations access database files directly, or install a Server Enhancement Module (SEM), which off-loads the processing of document requests to the server. An SEM significantly reduces network traffic and also provides increased data security, but it costs an extra \$1,995.

SoftSolutions' configuration process falls in the middle of those reviewed; it's not

as easy to configure as PC DOCS Open, but not as difficult as Saros's Mezzanine. We configured the system by maneuvering through a set of interrelated configuration screens, which manage such things as security, application support, and custom file fields. We also set up the file and directory structure for SoftSolutions to use when saving new documents into the system. For example, we could have SoftSolutions create new directories for each author in the system, with subdirectories for each of the author's projects. At times, we found the interface design awkward, making it hard to maneuver through the screens. But the informative administrator's manual helped us make our configuration changes.

End users use the same interface to log on to the SoftSolutions system and to perform searches for documents. While not as attractive as the PC DOCS Open or Visual Recall interfaces, it is quite usable. You can search using either profile data or full text, and you can combine multiple search criteria with Boolean operators—AND,

Continues on page NE12

CHAMELEON 4.0

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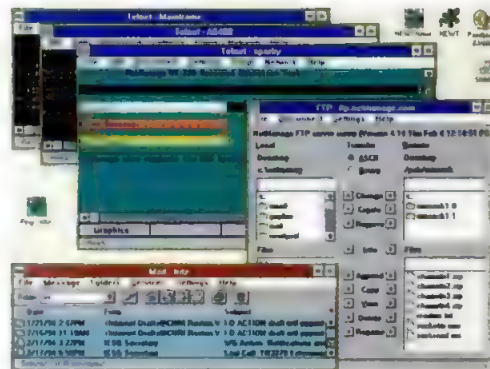
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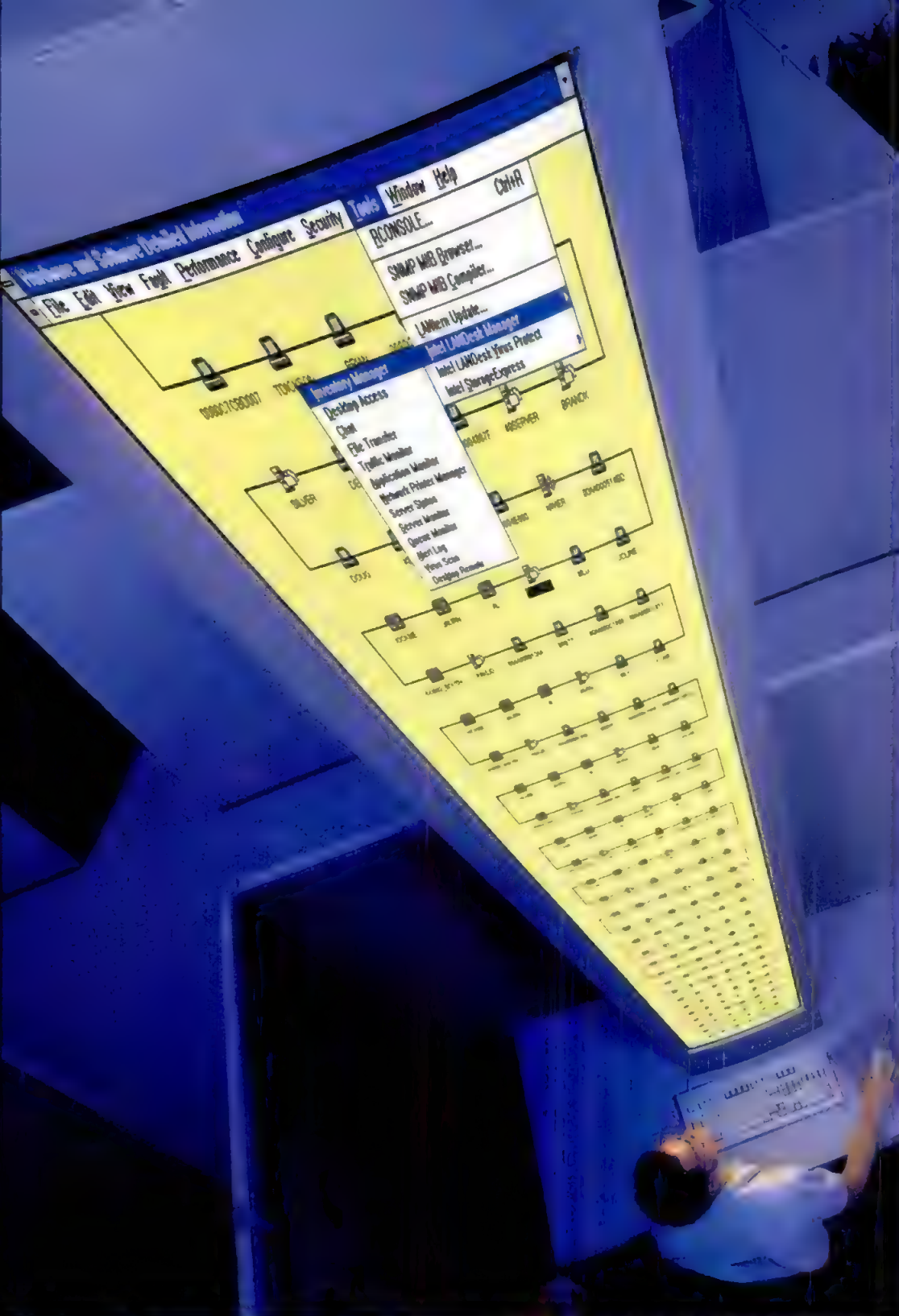


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Document Management

CONTINUED FROM NE10

OR, and NOT, for instance. Furthermore, SoftSolutions integrated into all the applications that we used.

With the optional SoftSolutions Suite, Novell includes another interface called the Document Desktop. This program let us create folders to store documents, create icons to perform commonly used searches automatically, and launch our favorite applications. Document Desktop makes it easier to store work; many users, in fact, will place Document Desktop in the Windows Startup folder and do most work directly from Document Desktop.

SoftSolutions was recently purchased by WordPerfect, and now is owned by Novell as a result of the Novell/WordPerfect merger. SoftSolutions is a solid DMS package; with the optional SEM and Document Desktop, it rivals PC DOCS Open in power and features. It's not as easy to use as PC DOCS, but it's close.

► **SoftSolutions, Version 4.0.** List price: \$495 per server; \$295 per client. SoftSolutions Suite, \$695 per server, \$395 per client. Novell Inc., 1555 N. Technology Way, Orem, UT 84057; 801-226-6000; fax, 801-224-0920.

Circle 967 on reader service card

XSoft

• Visual Recall

Designed primarily for NetWare LANs and standalone workstations, Visual Recall, Version 1.0, provides an elegant user interface to let you retrieve hundreds of documents. Its biggest shortcoming, however, is its lack of direct integration with Windows applications.

Installing Visual Recall is very easy. We mapped a drive to the NetWare server from a Windows workstation and installed the software from that workstation. Visual Recall stores all of its database files on the file server, and it

► SUMMARY OF FEATURES

Document Management Systems

PC MAGAZINE
NETWORK EDITION
EDITORS' CHOICE

Products listed in alphabetical order

■ = YES □ = NO

List price

**Mezzanine 3.10c,
Document
Manager 1.0**

Mezzanine,
\$330 per seat;
both packages
\$495 per seat

**PC DOCS
Open 2.0**

\$495 per server,
\$299 per client

**SoftSolutions
4.0**

\$495 per server,
\$295 per client

**Visual Recall
1.0**

\$395

Network Support

Network operating systems supported
Microsoft Windows NT Advanced Server
NetWare 3.x, 4.x
OS/2 LAN Server
VINES
Client platforms supported

■	■	■	□
■	■	■	■
■	■	■	□
■	■	■	□
■	■	■	■

Database Engines

Search and profile engine used

Sybase SQL Server derivative	Microsoft SQL Server (OS/2, Windows NT), Oracle7 Server (NetWare, Unix), Sybase SQL Server (NetWare, Unix), Watcom SQL Network Server	Proprietary	Btrieve
---------------------------------	---	-------------	---------

Complies with SQL

Full-text engine used

■	■	□	□
Fulcrum	InfoLink	Proprietary	Proprietary

Document Indexing and Searching

Can index by author
Can index by date
Can create custom fields in profiles
Can index and search document text
Can search multiple document servers simultaneously
Can use multiple criteria in searches
Can use Boolean AND, OR in searches
Can include wildcards in searches

■	■	■	■
■	■	■	■
■	■	■	■
■	■	■	■
■	■	■	■
■	■	■	■
■	■	■	■
■	■	■	■

Document Management

Automatically assigns DOS filenames
Overrides File/Open and File/Save dialog boxes
Tracks multiple versions of a document
Complies with MAPI/VIM
Can restrict user access to documents
Includes document browser
Can create usage reports
Signals files to be archived

■	■	■	■
■	■	■	□
■	■	■	■
■	■	■	■
■	■	□	□
■	■	■	■
■	■	■	■
■	■	■	■

*— Document Manager is required for Windows support

indexes files on the Windows workstation.

Documents are stored in cabinets. You can create standalone cabinets on your local hard disk, or you can create sharable cabinets, which you place on the network. If your cabinets are shared, you can assign security to different users and groups on a per-cabinet but not per-document basis. When you create cabinets, you also select the set of property information, such as author or account number, that you will associate with all the documents in the cabinet. In general, the process is very

straightforward, and the documentation is clear and helpful.

Unfortunately, saving documents using Visual Recall is a two-step process: First we saved the document using the standard File/Save dialog box, and then we had to go to Visual Recall and check the document in to Visual Recall. This extra step is annoying, especially since all the other packages currently offer direct integration with many Windows applications.

The main selling point of Visual Recall, however, is its advanced document-retrieval system. Using the mouse,

Continues on page NE15



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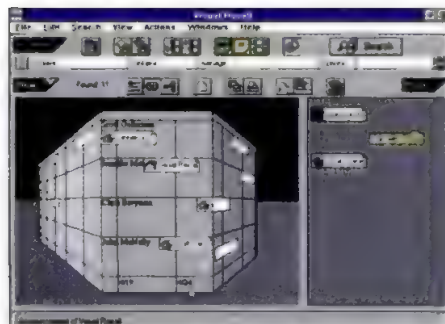
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Document Management

CONTINUED FROM NE12

we could create simple English clauses, which can be combined using Boolean operators such as AND and OR, to specify all of our search criteria. We could search either document properties or full text and find documents containing all words based on the same root, such as *mice* for *mouse*. The other packages in the



WALL OF RECALL: XSoft uses a grid view that plots documents on a 3D wall.

roundup provide the same functionality—with an additional package.

Visual Recall also provides the best tools to display documents. They can be viewed in three ways: a List view, which displays the documents in a sorted list; a Tree view, which provides a hierarchical perspective of document relationships based on document properties; and a Grid view, which plots all documents on a three-dimensional wall to show their progression over time. Visual Recall also let us create folders to manage our documents and save search criteria for later use.

In general, Visual Recall is easy to use and visually impressive. With tighter

SUITABILITY TO TASK Visual Recall

Installation and configuration	EXCELLENT
Creation and manipulation	FAIR
Document retrieval	EXCELLENT
Ongoing maintenance	FAIR

application integration, it will be a suitable choice for NetWare LANs. **► Visual Recall, Version 1.0.** List Price: \$395 per seat. XSoft, a division of Xerox Corp., 3400 Hillview Ave., Palo Alto, CA 94304; 800-428-2995; fax, 415-813-7162. Circle 968 on reader service card

JOHN GARRIS is a technical analyst for PC Magazine Network Edition.

► NETWORK MANAGEMENT

HP and IBM Open the Window on SNMP

BY JEFFREY D. BAHER

Hewlett-Packard Co. and IBM Corp., both heavyweights in the network management market, have released new Windows-based SNMP management platforms—HP OpenView for Windows Workgroup Node Manager (WNM), Version 1.0, and IBM's NetView for Windows, Version 1.0. Although the products are similar in purpose, OpenView WNM is a notch above NetView for Windows.

Hewlett-Packard Co.

• HP OpenView for Windows Workgroup Node Manager

HP OpenView for Windows Workgroup Node Manager, Version 1.0 (\$1,495), is a very impressive product, with a refined interface, strong feature set, and wide array of third-party application support. The key to OpenView WNM is its maturity: Although this is the initial release and the first version of OpenView sold directly by HP, it is based on the code from HP OpenView for Windows, Version 7.2. Previous versions of OpenView, including HP OpenView for Unix, were sold only as software developer's kits or in OEM bundles.

OpenView WNM comes bundled with FTP Software's TCP/IP stack as well as two SNMP appli-

cations: Ex Machina's Notify!, which pages network administrators of network alarms, and Intel's Desktop Remote, which allows administrators to take over remote client PCs from the management console.

How does OpenView WNM differ from OpenView for Windows? The big difference is that OpenView WNM can exchange information with the more powerful OpenView for Unix platform; OpenView for Windows cannot.

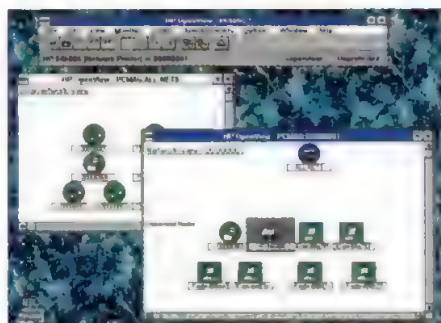
UP AND RUNNING

OpenView WNM installed easily on our NetWare 3.12 network. We were up and running in minutes, even though the product requires a sizable 540K of conventional memory. We were impressed with the automatic discovery and mapping of our IP and IPX network devices. We only had to input a few parameters and OpenView WNM took over, quickly displaying our entire network as an organized, hierarchical collection of icons. There are a few minor deficiencies in the autodiscovery process, such as the lack of support for AppleTalk devices and a ring graphic for FDDI segments (our FDDI ring was depicted as just another Ethernet segment).

Navigating the interface was a breeze. We were able to browse our network map

and network devices for status information with ease.

Like any product, OpenView WNM has some room for improvement. For example, it only allows you to query and graph MIB (management information base) values in real time;



NETWORK ROAD MAP: OpenView WNM automatically generates easy-to-read network maps.

it does not support historical analysis, which is often helpful to determine trends in network statistics. Also, since OpenView WNM doesn't support trouble ticketing (which allows you to tag and annotate SNMP alarms), you'll need a third-party application like Remedy Corp.'s Action Request System for that.

Fortunately, third-party applications for OpenView WNM abound. This is due primarily to OpenView's six-year presence (also, applications written for OpenView for Windows will work with OpenView WNM). In addition to the included Notify! and Desktop Remote, applications are available from Cabletron Systems, Cisco Systems, SynOptics Communications, 3Com Corp., and Wellfleet Communications for managing each vendor's hardware. HP also offers applications of its own for HP server, bridge, hub, and router management, as well as remote monitoring (RMON). OpenView WNM also integrates tightly with Intel's LanDesk, which provides a variety of features geared specifically to managing each client PC, including hardware and software inventory.

Overall, HP OpenView for Windows Workgroup Node Manager is very impressive. Everything from the interface design, to the management functions, to the third-party applications make it a strong platform on which to build your management system.

► HP OpenView for Windows

Workgroup Node Manager, Version 1.0.

List price: \$1,495. Hewlett-Packard Co., 5301 Steven's Creek Blvd., Santa Clara, CA 95052. 800-752-0900; fax, 408-553-3417.

Circle 951 on reader service card

IBM Corp.

• NetView for Windows

NetView for Windows is IBM's first foray into network management for the Windows environment. As a first effort, it is basically a decent product, with a good interface and strong third-party application support. But NetView for Windows lacks several key elements—not the least of which is IPX support—and stacks up

► SUMMARY OF FEATURES

Network Management

Products listed in alphabetical order	HP OpenView for Windows Workgroup Node Manager 1.0	NetView for Windows 1.0
List price	\$1,495	\$1,420 until 12/31/94, \$1,895 thereafter
Performs auto-discovery of devices	■	□
Maps network automatically	■	□
Monitors alarms and traps	■	■
MIB browser	■	■
SNMP polling	■	■
Supports trouble ticketing	□	■
Protocols supported		
AppleTalk	□	□
IPX	■	□
TCP/IP	■	■

poorly against OpenView WNM.

NetView for Windows (\$1,420 until January 1995; \$1,895 thereafter) is based on code for a product called NMC Vision that IBM acquired from Network Managers Inc. The product ships with no applications, but it does include NetManage's Chameleon 4.0 TCP/IP stack for IP connectivity.

Like HP, IBM is no newcomer to the network management market. Various NetView platforms have been available for years, particularly NetView/390 (for IBM mainframe environments) and NetView/6000 (a Unix-based platform that rivals HP OpenView for Unix). Recently, IBM rolled out NetView for OS/2 (formerly LAN NetView; see Network Edition, First Looks, February 22, 1994). Unfortunately, none of these platforms can communicate with one another.

SETUP AND FEATURES

NetView for Windows installed quickly on our test network. But we had to enter every network device manually; NetView for Windows does not include an autodiscovery feature.

Since there's no autodiscovery, there's no automatic mapping. We had to create all of our map views and place devices on

them one by one. Fortunately, NetView offers a hierarchical mapping structure that simplifies the process.

While lack of autodiscovery and automatic network mapping make NetView for Windows somewhat inconvenient, its lack of IPX support is a major drawback. Currently, NetView for Windows can only manage IP devices and networks, which significantly limits the product's appeal.

To be fair, management of IP devices is strong. The interface made many tasks, such as polling devices for SNMP alarms and

traps, just as easy as OpenView WNM did. In addition, NetView for Windows, unlike the HP product, offers a built-in trouble-ticketing feature. We were also impressed with NetView for Windows' performance-monitoring capabilities, which allowed us to receive real-time and historical data on individual network devices from the management console.

Third-party application support is near-

ly as vast as OpenView WNM's: All applications written for NMC Vision will work with NetView for Windows. This includes applications from Cabletron, Cisco, SynOptics, 3Com, and Wellfleet, among others. IBM offers three applications of its own for managing



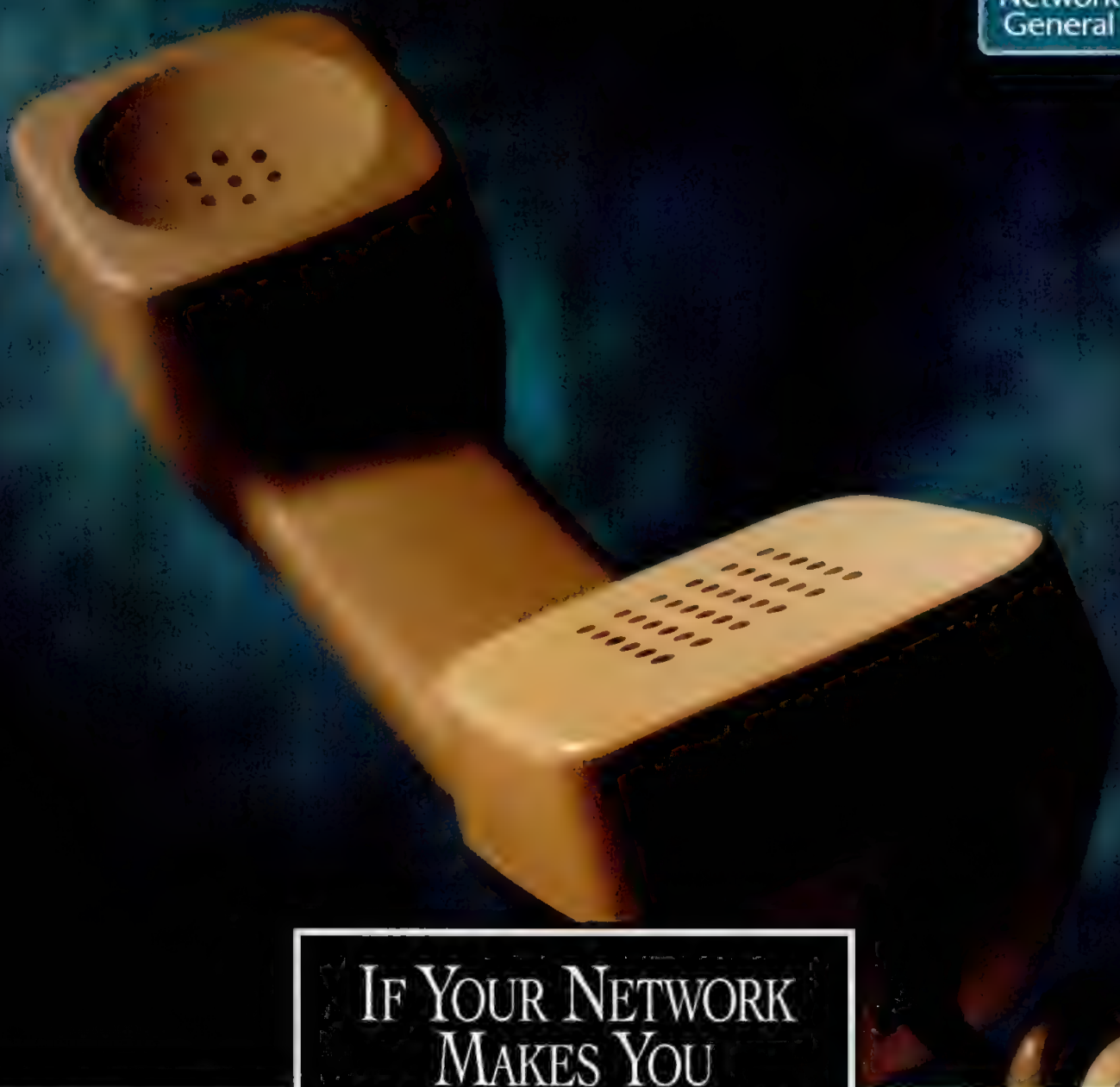
MANUAL MAPPING: NetView for Windows doesn't map automatically, but it displays FDDI rings.

IBM hubs and switches. Unlike OpenView WNM, no applications are currently available for RMON or hardware and software inventory.

Overall, NetView for Windows provides a decent array of SNMP management features and good third-party support, but it needs to address critical deficiencies, such as the lack of IPX support.

► **NetView for Windows, \$1,420 (\$1,895 starting January 1995).** IBM Corp., P.O. Box 2150, Atlanta, GA 30301-9949. 800-426-2255; fax, 404-238-3442.

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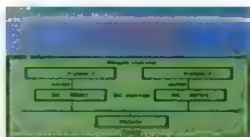


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► FAULT TOLERANCE

LANshadow Knows How to Protect Your Data

BY PADRAIC BOYLE

You need to protect your data, but high-end fault-tolerant solutions are expensive. Horizon Technologies Inc. (HTI) may have the answer: LANshadow, Version 4.0, is a low-cost, software-only solution that preserves files on the server's hard disk by mirroring them to another available hard disk. LANshadow does not provide complete protection against sudden hardware failures nor all types of data loss, but it may be the ideal solution for small to medium-size NetWare LANs that need to protect only certain files.

LANshadow (\$995 for the first server, \$395 for each additional server) comprises an NLM that runs on NetWare 3.x and 4.x servers and a Windows front end that runs on the network administrator's PC. LANshadow protects your data by periodically copying, or *mirroring*, user-specified files from a *source* server to a *destination* server, over LAN or WAN links. Since the destination server does not have to take over for the source server, the two machines do not have to be identical—as they do with NetWare System Fault Tolerance, Level III (SFT III). Thus, so long as there is sufficient disk space available, any NetWare volume will suffice (even another hard disk in the same server).

Unlike SFT III (\$2,595 to \$18,995, including NetWare 3.12), which provides a complete secondary server that immediately takes over all of the primary server's functions in the event of a hardware failure, LANshadow maintains copies only of those files selected by the user. Similarly, Vinca Corp.'s \$1,795 StandbyServer also provides a secondary server, although it does not switch over automatically and therefore costs thousands of dollars less than SFT III with its required hardware. (For further information about StandbyServer, see its review in *PC Magazine*, Network Edition, First Looks, April 26, 1994.) Unlike these two products, LANshadow does not back up the entire server and does not switch over to the secondary server if the primary server fails.

We installed LANshadow on a NetWare 3.12 network in only a few minutes. Through the easy-to-use Windows-based man-

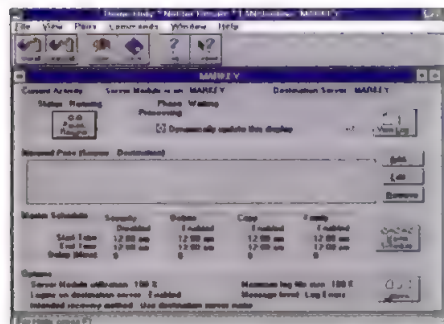
LANshadow 4.0: Pros and Cons

BENEFIT	TRADE-OFF
• LANshadow is affordable (only \$995 for the first server and \$395 for each additional server) • LANshadow allows users to access files on a backup server if the primary server fails	• It doesn't provide certain fault tolerant features that more expensive solutions offer, such as RAM mirroring • To access the backup server, users must log on again and, in many cases, reboot

agement utility, we selected our source server and the specific files we wanted to mirror to another disk. Once we selected the files, we were prompted by the program for a destination drive, which can be any available NetWare volume. To complete the setup process, we designated how often we wanted our files mirrored. One nice feature: We chose to back up some of our login scripts and LANshadow scanned them for any mention

of the source server, which it then replaced with the name of our destination server. This is especially handy if you include server names in your login scripts to automate users' logins.

LANshadow can hardly be called transparent to the end user. In



MIRROR, MIRROR: LANshadow's GUI has several configuration options for mirrored pairs.

most cases, we had to login to the destination server to get our files when the source server went down. This could pose a problem if the network administrator doesn't include the server names in users' login scripts, because the users will have to know the destination server's name. A few times, however, we had to reboot our client to reestablish our network connection, at which point we still had to login to the destination server.

This brings up two notable drawbacks to HTI's product. First, SFT III and StandbyServer maintain users' network connections when the switch is made to the secondary server, so with SFT III and StandbyServer administrators are less likely to get calls from angry users when something bad happens in the server room. With LANshadow, each user has to login to the network again—to a different server—when the primary server fails. This is one of the tradeoffs you have to make for choosing a low-end fault-tolerance solution.

Furthermore, LANshadow cannot mirror any open files or the source server's RAM. This relatively high-end feature is thus far provided only by SFT III, but when you consider that you can lose not only an entire file (such as a database you've worked on all morning without saving) but all pending print jobs waiting in the queue, as well as anything else that happens to be open or in memory, the value of such a feature becomes clear.

Still, LANshadow is intended only to protect specific files from disaster at a reasonable price, and it delivers as promised. This affordable and effective package could be the low-end solution for data protection that many NetWare sites are looking for.

► **LANshadow, Version 4.0.** List price: First server, \$995; each additional server, \$395. Horizons Technology Inc., 3990 Ruffin Rd., San Diego, CA 92123-1826; 619-292-8320; fax, 619-565-1175.

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► NETWORK MANAGEMENT

Take Command of Your Remote Devices

BY STEVE RIGNEY

E-Comms' new E-Commander is a truly unique solution for managing devices and facilities at remote sites. Through a series of add-on modules, the E-Commander can reboot file servers, monitor a wiring closet's temperature, and analyze traffic on remote network segments—all from a single PC in your central office, no matter what the distance is to the remote site.

E-Commander (\$3,500) is a small, rack-mountable device that resides at a remote site, while the included Windows-based E-Manager software runs on a PC in your office. The E-Commander connects to the network and contains the SNMP MIBs (I, II, and a proprietary MIB) and agents necessary to relay information from E-Commander's modules back to the E-Manager console. There are currently four rack-mountable modules available for the E-Commander: the E-Cat-5, which allows you to analyze the status and traffic on remote wire segments; the E-Data, which permits physical layer switching of connections to remote devices; the E-Log, which can monitor switched circuits (such as thermostats); and the E-Power, which controls power connections to remote devices. The E-Cat-5 costs \$1,595; each of the other modules costs \$1,095.

The E-Commander communicates with the E-Manager software via TCP/IP; a copy of NetManage's Newt TCP/IP protocol stack is included with the package. While Newt is fairly easy to install, you need to input the IP addresses and related information for your network devices. E-Manager's smooth interface provides point-and-click access to every function available through the E-Commander.

We tested the E-Commander with the E-Cat-5, E-Log, and E-Power modules on a NetWare 3.12 network. It took us about an hour to set up the entire system.

During installation, we set up all the modules in a single rack with the E-Commander on top so that we could test the product's unique *visual light path* (VLP) system. VLP uses a series of LEDs on each module to pass information. VLP is like a fiber-optic connection without the fiber. In order for this to work, the VLP connectors must be aligned perfectly. We were very impressed with VLP, because it worked flawlessly and eliminated the need to string cables between all of the modules. If you do need to set up the system in multiple racks, you can connect all of the modules via RS-485 cables (not included).

THE MODULES

So, what exactly did each module allow us to do? To begin with, the E-Power module gave us control over five power connections, three of which we used to connect a file server, a hub, and a UPS. We were then able to cycle the power to each of these devices from the E-Manager console. We found this a very valuable function considering that many simple net-

working problems can be solved by rebooting the offending device.

The E-Data module allowed us to manage both our UPS and hub with a single terminal and modem, using out-of-band management. We simply attached a modem to one of the E-Data's serial ports. The UPS and hub were connected to two of the E-Data's seven other serial ports. Once we dialed into the E-Data, we used the Windows Terminal to monitor the status of our UPS batteries. We then used E-Manager to switch the dial-

up connection over to the hub, where we monitored the status of each port. Of course, this will only work if your devices can be managed out-of-band (via a direct serial connection).

We used the E-Cat-5 to connect a cable scanner to multiple network

segments. The E-Cat-5 has 13 RJ-45 ports. The scanner, a Microtest QuickScanner, was attached to one port, and Ethernet segments were attached to three of the other ports. From the E-Manager console, we were able to scan the three segments individually by switching the QuickScanner from one segment to another. The E-Cat-5 is available for both Ethernet and Token-Ring, though it only supports RJ-45 (UTP) connections.

The E-Log module, which we did not test, has either 8 or 25 connections for switched circuits, such as thermostats and motion detectors. For example, you could use the E-Log to notify you of any temperature changes in your remote site's wiring closet. This module is similar to Cincinnati Networking Products' Remote Temperature Monitor Model CNP-4 (see Network Edition, First Looks, July 1994).

Simply put, if you have remote devices and facilities that you need to monitor and control, the E-Commander is a unique and affordable method for doing so. The wide range of functions available through its add-on modules and the VLP connectors set it apart from any network management product we've seen. □



COMMAND AND CONTROL: E-Commander lets you monitor and control remote facilities.

► FACT FILE

E-Commander

List price: \$3,500 (includes E-Manager software), E-Cat-5 module, \$1,595, E-Data module, \$1,095, E-Log module, \$1,095, E-Power module, \$1,095. **In short:** The E-Commander and its associated cast of add-on modules provide a unique method for monitoring and controlling your remote network devices. You can use the E-Commander to reboot servers remotely and even to monitor the temperature in a remote wiring closet. You access all management functions through the Windows-based E-Manager software, which is very easy to use.

E-Comms Inc., 5720 144th St. NW, Gig Harbor, WA 98322, 206-857-3399, fax, 206-857-3444

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CIRCLE 903 ON READER SERVICE CARD

► COMMUNICATIONS SERVERS

Communique Does It All with One Bus

BY STEVE RIGNEY

CommVision Corp.'s new Communique series of communications servers utilize a unique bus-switching technology to support your faxing, remote access, and other communications needs in a single device. Like most high-end communications servers, however, the Communique systems carry hefty price tags.

There are two models in the Communique series: the eight-slot Communique Workgroup and the 20-slot Communique Enterprise. Neither solution is inexpensive: You can expect to pay anywhere from \$7,000 to \$35,000 depending on the system's configuration.

The Communique servers all utilize a single *master* CPU card, which typically contains an Intel 486DX or DX2, and several *slave* CPU cards, which usually contain Cyrix 386 or 486 CPUs. The master card acts as a NetWare 3.x file server and controls the entire Communique system, while each of the slave cards handles a different application or task. For example, we ran three of our CPU cards as a remote access server, a fax server, and an e-mail gateway. The Communique Enterprise, which we tested, can hold up to 17 slave cards. Because of the master/slave architecture, however, the entire Communique system will go down if anything happens to the master card. This possibility can be enough to worry the most stalwart of network administrators, in spite of the fault-tolerance features—multiple fans and redundant power supplies.

Like the Cubix ERS/FT and the Evergreen CAPserver (both reviewed in "Remote Access: It All Comes Down to Management," Network Edition, August 1994), the Communique servers support multiple CPUs on a single, large backplane. The difference is CommVision's proprietary high-speed (44-Mbps to 132-Mbps), packet-switching

backplane. This backplane, called the PacketBus, allows each of the CPUs to have concurrent access to the network. This means that the Communique needs only a single network adapter, which each of the slave cards shares. The CAPserver, in contrast, requires a separate adapter for each CPU card. Although the PacketBus backplane is proprietary, it supports standard ISA and EISA adapters.

The Communique Enterprise server comes in an impressive-looking tower case that includes five cooling fans and three 300-watt power supplies (one of which is a backup unit) for fault tolerance—which is key when you put so many crucial elements into a single device. As with the Cubix and Evergreen servers, all of the Communique's power supplies are hot-swappable, so you can replace them without taking the server down.

Every Communique server comes preconfigured to the user's hardware and software specifications. Our Communique Enterprise server came with one 486DX master CPU, four 486 application processors, a Brooktrout TR112-LL fax card, a DigiBoard PC/4E I/O adapter, and a generic NE2000-compatible network adapter. Plenty of software was also loaded: a 10-user license of NetWare 3.12, NetWare Connect 1.0, NetWare MHS 1.5, Intel's LANSight 4.0, Wildcat! BBS Suite 4.0, Optus's FACSys 3.40, and Ocean Isle's ReachOut Remote Control Pro Edition 4.02. CommVision provides customer support for all of the hardware and software that

is bundled with a Communique server. CommVision can also configure all Communique servers with your network and user information.

Because our system came with everything preconfigured, our installation was about as simple as you can get. We were dialing into the unit within an hour after it was delivered.

From multiple clients, we simultaneously dialed into the Communique server to access the Wildcat! BBS, the fax server, and the NetWare Connect remote-node server. Although we didn't

run any specific performance tests, we saw reasonably good performance on all our connections.

Unlike the Cubix and Evergreen servers, the Communique unit does not have a monitor and keyboard switch, which would allow you to share a single keyboard and monitor for all of the CPU cards. This seems odd; since all the CPU cards can share a single network adapter, why can't they share a keyboard and monitor? As an alternative, we used the

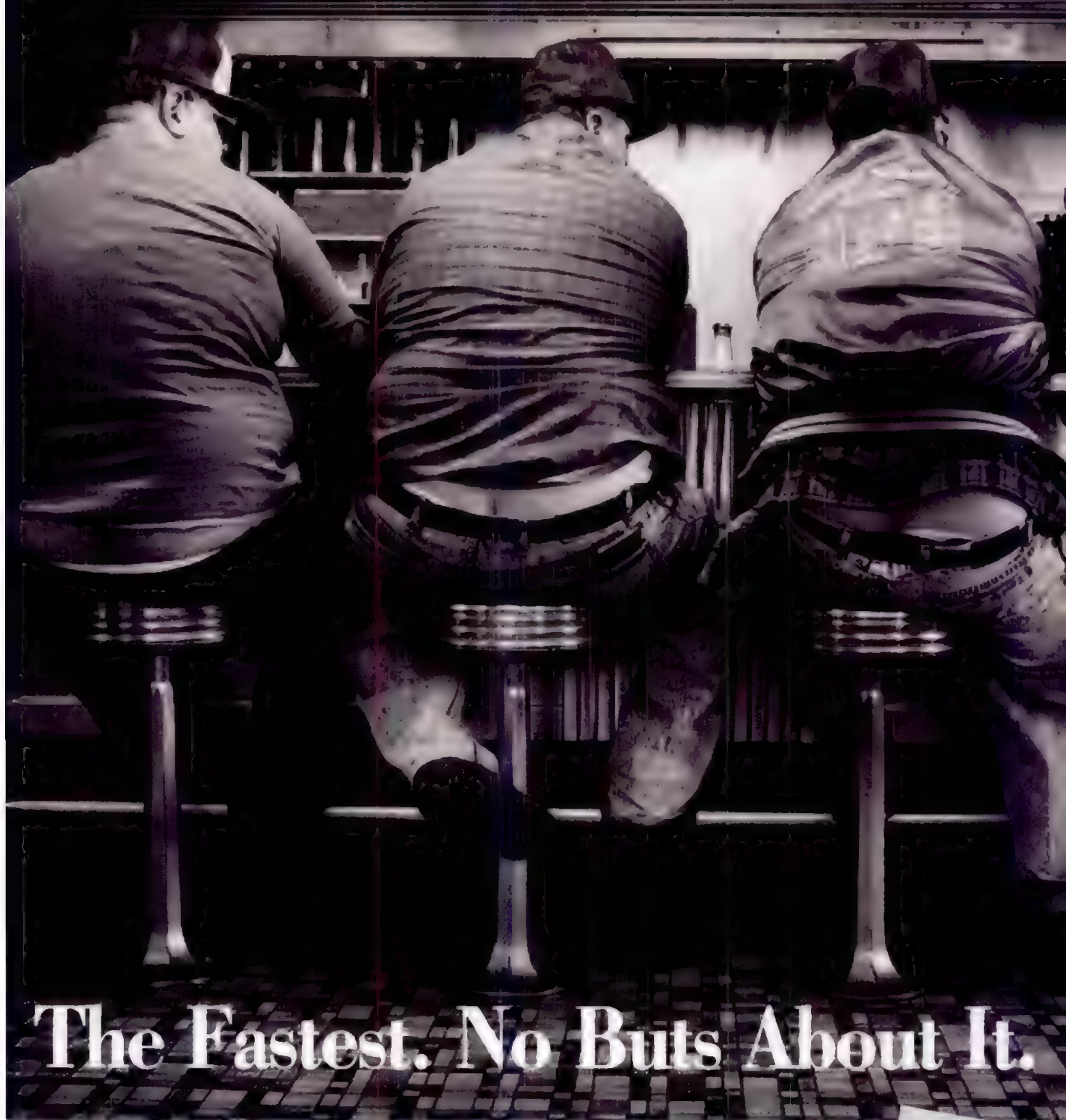


ALL-IN-ONE SOLUTION: Communique servers can hold everything from fax and remote access servers to your BBS.

ReachOut Remote Control software, which allowed us to control and monitor each CPU from a Windows client on the network.

The Communique servers' unique PacketBus is impressive and these systems can indeed consolidate all of your communications needs. It is important to remember, however, that this architecture leaves you at the mercy of the master CPU, but the Communique servers are definitely a force to be reckoned with in the high-end communications server market.

► **Communique Enterprise.** List price: \$31,000 (as tested). CommVision Corp., 510 Logue Ave., Mountain View, CA 94043. 415-254-5270; fax, 415-254-9320. Circle 960 on reader service card



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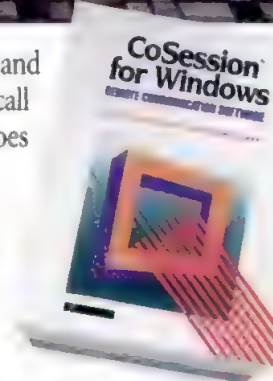
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News of announced network products and upgrades

By Vicki B. Jacobson

NEW

NiceCom Streamlines Ethernet-to-ATM Migration

NiceCom hopes to make getting to asynchronous transfer mode (ATM) a bit easier with its new family of switches. The NiCell switches allow network managers to connect workgroups, departmental, and backbone environments using Ethernet as a progression to ATM.

The NiCell switches allow users to upgrade to ATM from a variety of starting points. The NiCell 200 Workgroup Switch is designed for workgroups that want to upgrade to dedicated Ethernet connections. The NiCell 1200 Departmental Switch builds on the entry-level switch with its ability to accommodate up to 5,000 users. The 1200 features up to 48 switched Ethernet ports and 4 ATM ports, and optional redundancy features including power supplies and processors. The high-end NiCell 2000 Backbone Switch features 16 ATM ports and the same optional redundancy features as the 1200.

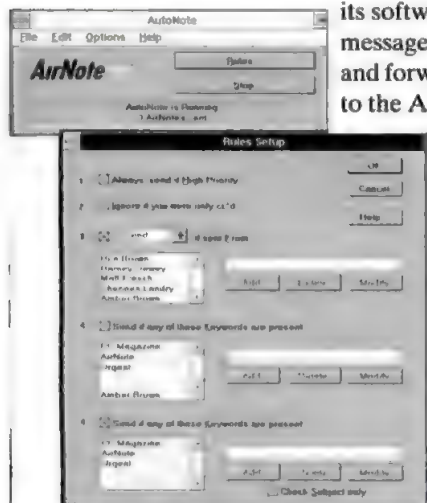
All of the switches offer support for the creation of virtual LANs. These virtual LANs, as well as other switch configurations and traffic patterns, can be monitored from the accompanying management application. The management software supports SNMP and runs on HP OpenView.

► **NiCell 200 Workgroup Switch.** List price: \$8,400. **NiCell 1200 Departmental Switch.** List price: \$48,100. **NiCell 2000 Backbone Switch.** List price: \$39,600. NiceCom Inc., 74 Bedford St., Lexington, MA 02173; 617-861-6112; fax, 617-861-5079. Circle 957 on reader service card

IMPROVED

AirNote Delivers All-in-One Messaging

While RadioMail moves all messaging to your computer, **Notable Technologies** relies on its software/hardware combo, the AirNote, to integrate all messages—phone, e-mail, and Internet. The software filters and forwards messages, viacomputer or operator assistance, to the AirNote text pager. Paging services are available via affiliations with PageNet and SkyTel.



AIRMAIL: With AirNote, mobile users can receive all of their messages.

Circle 962 on reader service card

You can receive messages sent by phone through the AirNote 24-hour messaging center; e-mail (cc:Mail, Lotus Notes, or Microsoft Mail) through a Windows machine equipped with a modem and the AirNote software; and Internet mail sent from systems such as America Online, AT&T, CompuServe, EasyLink, GENie, MCI Mail, and Prodigy. You can also set up rules and filters for your e-mail messages, assigning priority by sender, keywords, or subject.

► **AirNote.** List price: \$349; monthly service charges, \$19.95 to \$49.95. Notable Technologies Inc., 2030 Franklin St., 4th floor., Oakland, CA 94612; 800-732-9900, 510-208-4400; fax, 510-444-4493.

HOT PROSPECT

ATM Apps Made Easy

Application developers will soon be able to exploit the benefits of ATM networks easily with a new product line from First Virtual Corp. The product line—a network adapter, workgroup switch, and media server—promises one of the lowest prices we've seen: \$500 for the switch combination.

Until now, independent software vendors needed to know the arcane language of ATM in order to write ATM-enabled applications. First Virtual's Media Operating System hides these communication intricacies behind OLE. Need to initiate a videoconference? No problem. Pop in a videoconferencing OLE object from First Virtual Networks, for example, and you have instant and transparent access to ATM services.

The infrastructure underneath this software is equally impressive. There is an intelligent PC adapter that is software-configurable and supports ATM speeds of 25, 100, and 155 megabits per second (Mbps) and a stackable workgroup switch that provides from 8 to 24 full-duplex 25-Mbps ATM ports (additional port options include 51 Mbps, 100 Mbps, and 155 Mbps). These devices connect LANs and WANs as well as a line of ATM-attached server devices (jointly developed with Connor Peripherals) for Lotus Notes, NetWare, and Windows NT networks.

► **Media Operating System.** List price: \$2,000–\$12,000 (depending on the number of sessions). First Virtual Corp., 3393 Octavius Dr., #102, Santa Clara, CA 95054; 408-988-7070.

Circle 958 on reader service card

NEW

Kalpana Releases New Management App

Kalpana brings the functionality of Unix SNMP management platforms to Windows PC users—without the cost. SwitchVision for Windows is a network management application that allows network administrators to monitor and manage their Kalpana EtherSwitch switches, as well as their other SNMP devices, from a desktop.

SwitchVision for Windows has the capacity to manage over 1,000 SNMP devices, including routers, hubs, and bridges. The management software can perform such functions as automatic discovery and hierarchical mapping of SNMP devices, graphing of historical performance data, and drag-and-drop configurations of advanced EtherSwitch features.

► **SwitchVision for Windows.** List price: \$695. Kalpana Inc., 1154 E. Arques Ave., Sunnyvale, CA 94086-4602; 408-749-1600; fax, 408-749-1690.

Circle 954 on reader service card

NEW

Rockwell Goes Remote



ROAD ROVERS: RoadHopper connects up to 100 mobile users to their NetWare or TCP/IP LAN.

RoadHopper, the new remote-node server from Rockwell Network Systems, connects up to 100 roving commuters back to their NetWare or TCP/IP LAN. The hardware/software bundle provides full remote-node capabilities, including remote management, sharing of corporate resources, electronic mail, and file transfer.

RoadHopper includes software for Windows or DOS, PCMCIA- or ISA-bus modems, and a five-port remote-access server. RoadHopper supports SNMP for its management and

Rockwell's own SmartRoute software for IP and IPX routing between remote NetWare LANs.

► **RoadHopper.** List price: \$4,495. Rockwell Network Systems, 7402 Hollister Ave., Santa Barbara, CA 93117-2590; 800-262-8023, 805-968-4262.

Circle 955 on reader service card

NEW

Stand by Your Server

Vinca Corp. brings fault tolerance to your WAN with the Remote StandbyServer. By using frame relay and the Point-to-Point Protocol (PPP), users can connect a second server at a branch office to their corporate LAN. The Remote StandbyServer operates as backup to the main file server while providing WAN connectivity to a NetWare LAN.

Users at the branch office can still access critical data even if the primary server is down or performing backups or software distribution functions. The Remote StandbyServer ships with two WAN-interface cards developed in conjunction with Newport Systems.

► **Remote StandbyServer.** List price: \$6,995. Vinca Corp., 4000 Central Park East, 1815 S. State St., Orem, UT 84058; 800-934-9530, 801-223-3100; fax, 801-223-3107.

Circle 956 on reader service card

BRIEFS

BACKUP

Hewlett-Packard Co. announced two new storage products for NetWare networks. The HP SuperStore Tape 12000e (\$3,600) is an external, 6-cartridge digital audio tape autoloader that provides backup for multiserver environments with a capacity of over 5GB. The HP SuperStore 12000e LABS for NetWare (\$4,500), designed for servers with a capacity of from 1GB to 5GB, adds on the Low Admin Backup for Servers (LABS) backup software. The LABS software provides automated installation, backups, restores, and diagnostics. 800-752-0900.

Mountain Network Solutions

Version 1.1 of its FileSafe for Windows Rescue NLM backup software features an enhanced user interface and support for workstation backup. Version 1.1 (\$499) is also compliant with System Independent Data Format 1.0, an industry-standard tape format for interoperability between backup vendors. 408-438-6650.

NETWORK ANALYSIS

Microtest announced a new diagnostic tool, Compas (\$4,995), for solving wiring, network, and NetWare server problems. When a user pushes Compas's Diagnose button, it runs tests, identifies problems, and presents solutions. Compas can also be connected between a file server or workstation and a hub. 602-952-6400.

FTP Software's latest version of its software-based network analyzer features an easier-to-use user interface and increased protocol and network-driver support. LANWatch, Version 4.0 (\$1,200), now includes a mouse-driven interface and enhanced support for ODI and Token-Ring drivers. 800-282-4387.



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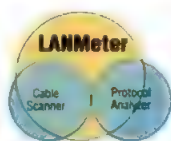
The LANMeter gets you out of all kinds of jams on Ethernet or Token Ring networks. Use it for real-time analysis of network errors, collisions or traffic statistics. Or spot

trouble ahead by using the LANMeter proactively for installations, benchmarking tune-ups, and network audits.

Nothing is easier to use than a LANMeter. You can learn how in 30 minutes or less. Answers appear at the push of a button without complex programming or wading through screens of decodes. And its compact size makes the LANMeter easy to use under a desk or in a wiring closet. All reasons why the LANMeter has won an armful of awards and was named **"The Best of Times" by LAN Times.**

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Fluke's LANMeter combines the best functions of traditional tools with unique new capabilities to solve more network problems than any other single tool.

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Tools for Healthier LANs

FLUKE.

IMPROVED

RadioMail Keeps Remote Users in Touch

RadioMail Corp. has announced a new call-in service for its remote users. RadioMail subscribers can now receive wireless messages at their laptop, palmtop, or personal digital assistant computers. A caller can use an 800 number in order to send a message to a RadioMail subscriber using the subscriber's name. Once the operator has determined that the message is acceptable, it is then sent to the RadioMail subscriber immediately. Messages can be of unlimited length; however, messages that are longer than 500 characters are sent as multiple messages. The service eliminates the need for RadioMail users to carry their pagers and cellular phones in order to receive messages other than e-mail.

► **RadioMail call-in service.** List price: \$89 per month. RadioMail Corp., 2600 Campus Dr., San Mateo, CA 94403; 415-286-7800; fax, 415-286-7801.

Circle 961 on reader service card

IMPROVED

Crosswise Brings You Face to Face

Crosswise Corp.'s document-conferencing software gets a new look with the addition of cross-platform support. Face to Face, Version 2.0, allows Windows and Macintosh users to review and annotate documents together in real time while they talk on the phone.

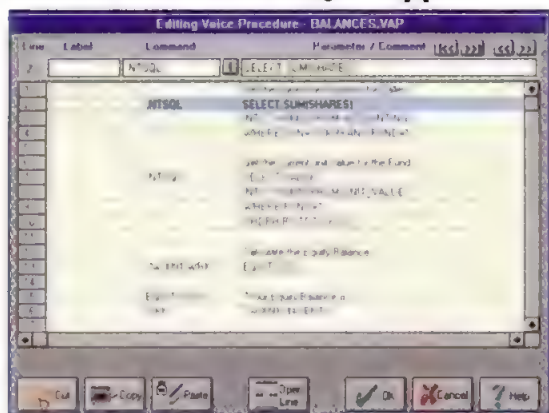
This latest offering also features the addition of support for TCP/IP networks, rounding out preexisting support for AppleTalk, NetWare, and ISDN. Other new features include a file-transfer utility and additional modem support. Version 2.0 also ships with a receive-only version of the software, Listener.

► **Face to Face, Version 2.0.** List price: \$179. Crosswise Corp., 105 Locust St., #301, Santa Cruz, CA 95060; 800-747-9060, 408-459-9060; fax, 408-426-3859.

Circle 953 on reader service card

IMPROVED

Cascade Enhances SQL Support



VOICE ACTIVATED: Voice Tools responds to caller requests for database information.

hoc calculations, and transmit faxes. The Voice Tools system also includes a development module for scripting and recording capabilities. □

► **Voice Tools.** List price: Starts at \$2,300. Cascade Technologies Inc., 1430 Broadway, 7th floor, New York, NY 10018-3308; 212-768-7380; fax, 212-768-7806.

Circle 969 on reader service card

BRIEFS

ADAPTERS

Thomas-Conrad Corp. announced price reductions of up to 15 percent on its line of Token-Ring and Ethernet PCMCIA adapters. The TC4141, a 16/4-Mbps Token-Ring PCMCIA adapter, now lists for \$479, down from \$543. The TCS141-T 10BaseT PCMCIA adapter sells for \$199 and the TC5141-2 10Base2 PCMCIA adapter is \$225, down from \$234 and \$262, respectively. 800-332-8683.

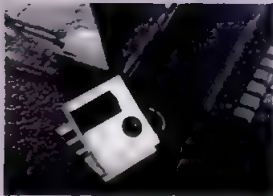
Socket Communications also reduced prices on its PCMCIA Ethernet adapter. The EA903 (EA+) now lists for \$249, down \$50. The EA903 supports both 10BaseT twisted pair and 10Base2 thin co-axial cable. The adapter also supports the Plug and Play standard. Compatibility with the Eagle NE3200 allows it to work with drivers for a variety of NOSs, including Microsoft LAN Manager, WfWG, and Windows NT; and NetWare 3.x and 4.x. 510-670-0300.

PRINTER SHARING

Emulex Corp. strengthened its support for NOSs with the addition of IBM's OS/2 LAN Server to its NET-Jet (\$499) and NETQue (\$599) printer-sharing devices. NETJet is an internal solution that works with HP's DesignJets, DeskJets, Laser-Jets, and PaintJets over an Ethernet network. NETQue is an external device that works with any printer or plotter in an Ethernet or Token-Ring environment. 800-854-7112.

InterConnections announced an external, multiprotocol printer-sharing device, PrintSelect. PrintSelect (\$629) features a parallel and a serial port, as well as support for AppleTalk, IP, IPX, and LAT environments. The device comes with 10BaseT and 10Base2 Ethernet connections. 800-950-5773.

GIVE MOBILE USERS THIS WIRELESS LAN SOLUTION AND THEY'LL MAKE THE CONNECTION INSTANTLY.



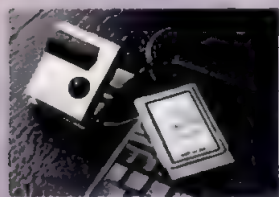
Photonics COLLABORATIVE is the most reliable and cost-effective in-building wireless network solution available.

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campus mobile computer users to network resources, all while they remain untethered. COLLABORATIVE will provide them live, continuously-connected roaming in facilities you designate. So your mobile users can instantly share files, synchronize calendars, use printers and access E-mail, just as if they were cabled directly to your LAN.

COLLABORATIVE also enables users to create their own full-featured, peer-to-peer LANs, usable on-campus or at any remote site. It's just what's needed for ad hoc work groups, for temporary networks anywhere. Perfect for use in conferences, meeting rooms, shared offices, classrooms and portable training areas.

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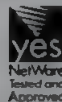
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The Database Answer?

ODBC spells universal access for some—and potential headaches for others.

By Brian Butler

Recently, small developers have turned to Microsoft to help them solve one of their most vexing problems: creating applications that can access different proprietary databases. The problem of course is that the APIs available to developers are necessarily

proprietary—except for one.

Microsoft's Open Database Connectivity (ODBC) API promises to save developers time and make life easier on users by enabling a single front-end application to access multiple back-end databases. With ODBC, standard Microsoft Windows applications—such as Lotus Approach and Microsoft Word—can use data stored in a SQL-based database.

On paper the idea looks great. It's much like writing to a printer driver, which developers have long done. An application developer would write the application to ODBC. Then, ODBC utilizes a "database driver" (provided by a third-party source, such as Intersolv or Microsoft) that maps the application's database calls to a particular back end. This way the application never needs to know the particular database being accessed.

Sounds simple, right? The problem is that databases are enormously more complex than printers. ODBC simply can't contain all of their functionality. So the original ODBC specification offered the

lowest common denominator: Only those commands that were common to a number of database APIs were included in the specification. Customers who purchase a particular database for an advanced feature set will find that they are unable to take advantage of those features via ODBC.

Microsoft did provide a pass-through mechanism so developers could exploit

this assumes that the developer knows two API's (the native API that the vendor supports, in addition to ODBC), which again increases complexity).

Another criticism leveled at ODBC has been its slow performance. Much of these comments were based on the first revision of the ODBC drivers; the drivers have improved with time. Many vendors, like Watcom International Corp., wrote their databases very close to the ANSI SQL specification, making them perfectly suited for ODBC. What's more, with many PC-based client/server applications focused on decision support, they just don't require the high performance demanded by on-line transaction processing (OLTP). Because there are bad drivers out there, you do need to be careful which driver you'll be using.

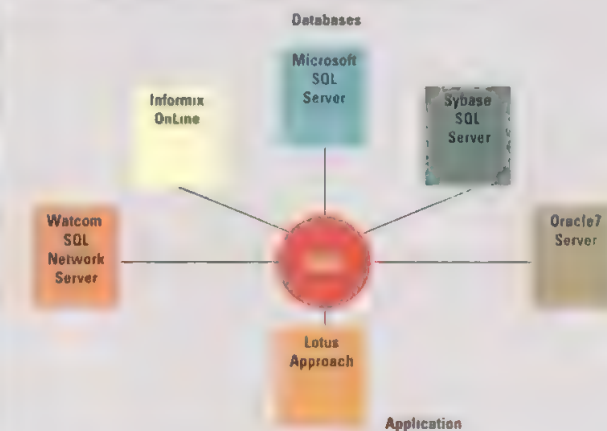
But the question remains: Who will benefit the most from ODBC? Probably small vendors and vendors of niche products. A value-added reseller (VAR) developing a billing program for doctors offices might consider writing to ODBC. This would give him a greater potential market than if he were to stretch his limited resources to support all the available database back ends. The same argument holds true for small companies developing niche products, such as report writers.

ODBC gives them a bigger market, and provides the market with new and innovative ideas.

ODBC also helps the small database companies like Watcom or XDB Systems. With ODBC, these vendors' tools gain access to front ends that would normally be available only to companies like Microsoft, Oracle, or Sybase. The vendors with the least to gain are companies such as Oracle, which has a huge installed base. □

One-Stop Shopping

With ODBC, developers can enable their applications to access several different types of databases by writing to a single API.



particular aspects of the database that are not covered by the ODBC specification. A good example is *stored procedures*, which is an extension to the basic four ANSI SQL commands, under Sybase SQL Server. Naturally, exploiting such features deprives your applications of the reason that you moved to ODBC in the first place—database independence. Still, if you did decide to port your application, you would have less code written in the native database format to port. Of course

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Is IBM's ATM a Good Thing?

David, this is going to hurt. I'm about to heap praise on IBM for bringing out a nonstandard, practically proprietary product—and it's ATM. My teeth are clenched so tightly that I'm losing enamel on my back molars. But in this case IBM deserves a lot of credit for what I'd normally label as a misguided act.

Let me set the background for this scene. You know that I'm skeptical over the value of the 100-megabit-per-second networking strategies—both 100BaseT and 100VG-AnyLAN. I think that opening PCs and walls to put in new adapters and (most likely) to pull new cable is a huge sheet of flypaper just waiting for network managers to land on it. Besides, I haven't seen the application or hardware that needs this kind of throughput.

As you also know, I'm equally skeptical about the ATM hype. This transmission scheme carries tons of overhead compared with frame relay. Its major saving grace is its ability to deliver video and sound in synchronization. This is a feature that the phone companies are going to love, but it may be of little help to corporations.

Finally, I'm always down on any proprietary technology. Open standards, on the other hand, make it possible for small companies to enter the market and flourish and for buyers to choose from among several sources of supply. Being stuck with an orphaned proprietary product is bad news.

After all that, I still have to say that I think IBM has a hit with its 25-megabit-per-second Turboways ATM system. Turboways runs across two pairs of UTP cable and is a lot less critical about the quality of those wire pairs than the 100-Mbps systems. The speed is just right for desktop services and for server-to-wiring hubs or connections. At a starting price of \$395 per card, the price is right too.

While 25-Mbps ATM isn't a closed proprietary system, it isn't a standard either. So for now you'll depend on IBM for adapters and hubs, but people have done that for years. Besides, a good idea is always copied in this market.

IBM's Turboways system is ready for multimedia applications and it's a logical way to introduce ATM into an organization. It hurts my jaw to say it, but "Well done, IBM!"



Frank Derfler:
I'm clenching my teeth. But I have to admit that IBM has a hit with its 25-Mbps solution.

Open wide, Frank. Do I have a shot of Novocain for you. IBM might have introduced a neat technology, but it takes more than technology to make a strong product. Take standards for instance. The 155-megabit-per-second signaling rate is part of the telephone industry's SONET architecture. This 25-Mbps stuff is part of nothing.

There are a few other problems I see. IBM's people might talk about bringing a bidirectional, dedicated 25-Mbps connection to the desktop, but they've just moved the toothache to the back of the mouth. Let me explain. IBM's 25-Mbps connections require one of its 14-port hubs to reach back to an ATM switch. The hub has a single, 155-Mbps interface and 14 25-Mbps connections. Do the math Frank. There's no way that every user will

get 25 Mbps and simultaneously use that link.

Now I know with your head stuck in the AT Age you're still thinking that even some portion of 25 Mbps is a lot of horsepower, but consider this. While we've more than doubled the bandwidth of the network connection, processor performance has jumped more than fivefold. A modern Pentium computer with a PCI bus can pump far more data down the network than a 286 with an ISA bus. The need for speed will build to fill the available capacity—whether it's in the

form of one of the 100-Mbps technologies or faster ATM.

The companies planning to bring high-quality digital video to every home are working with 600-Mbps pipes. If you plan to stick to 25-Mbps desktop links, you'll need excellent compression for video. That costs in terms of hardware, picture quality, and the high probability that vendor A's products won't work with vendor B's products. Bigger pipes give more room for growth.

When you factor in switched Ethernet configurations, 25-Mbps ATM doesn't seem like such a steal. Sure IBM's ATM cards may run about \$400 a node. But factor in the cost of a hub and a switch and you're spending over \$1,000 a node. And that doesn't even include the management cost associated with upgrading each PC's ATM cards. Ethernet switches cost far less and let you upgrade to higher performance without touching the desktop. When you outgrow dedicated Ethernet—in a few years or so—then you can make the jump to ATM, 155-Mbps ATM that is. □



David Greenfield:
Get your head out of the AT Age. IBM has just moved the toothache to the back of the mouth.



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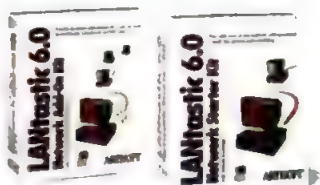




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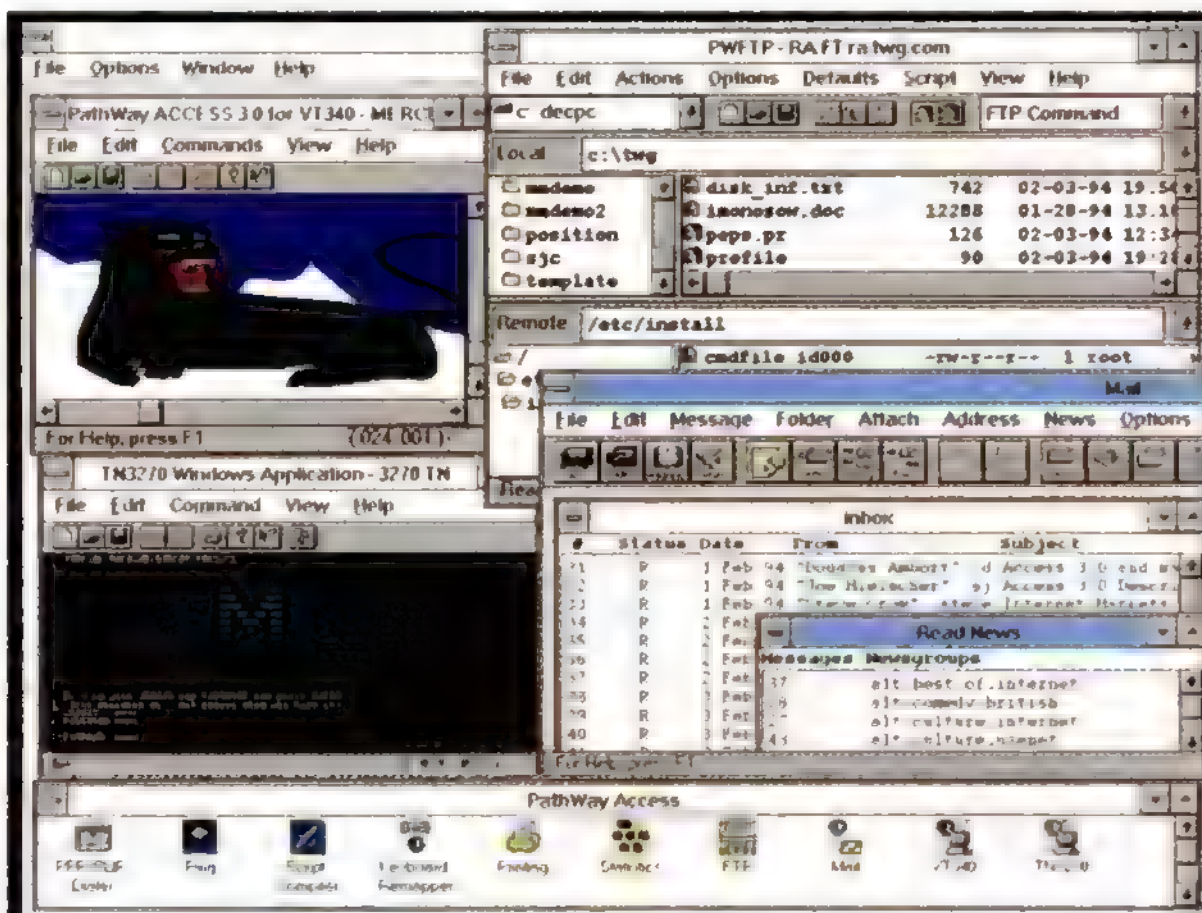
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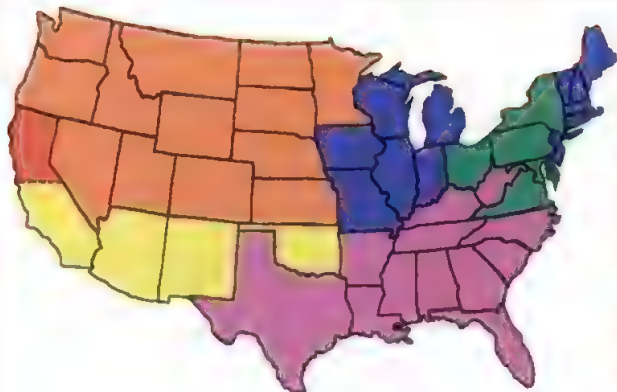
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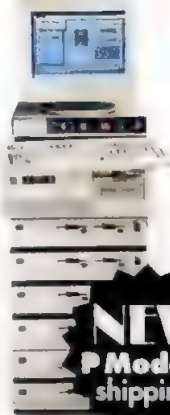
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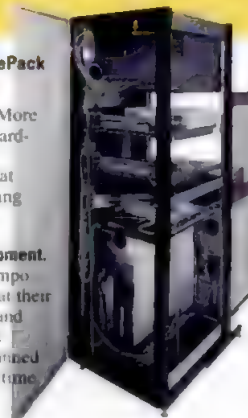
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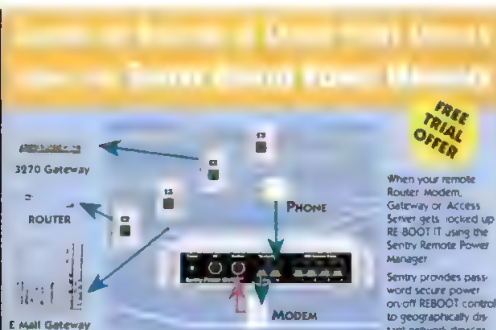


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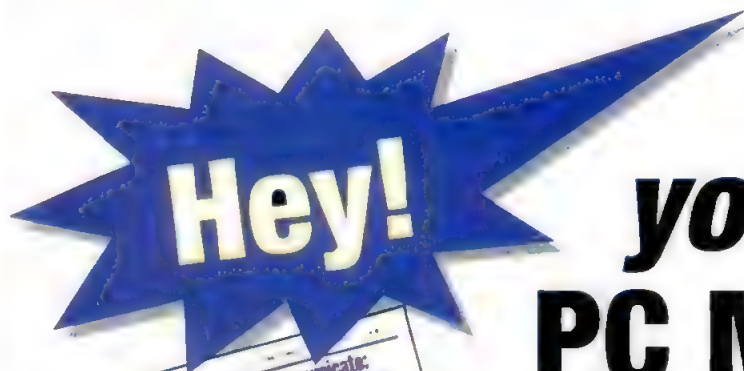
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User-to-User

BY NEIL J. RUBENKING

Testing Drive Readiness with a Batch File

I needed a way to test the readiness of a floppy disk drive while a batch file was running. There are utilities that do this, but they have to be distributed with the batch file and also must be available on the path. I wanted something intrinsic in DOS and preferably simple.

I decided to examine my old copies of *PC Magazine*. I didn't find the exact solution but did find the means: COMMAND.COM's undocumented /F switch, as described in the issue of March 17, 1992. The /F switch causes DOS to act as if the F key were pressed in response to the "Abort, Retry, Fail?" error message for all disk commands. The switch can be included on the SHELL= line of your CONFIG.SYS file but can also be used as a command line switch for a secondary

command processor. Using this knowledge, I came up with the technique shown in Figure 1 (DRVREADY.BAT).

The heart of the approach is the COMSPEC line. It invokes a second copy of the command processor with all output, including error messages, directed to the NUL device. The command line tests for the existence of the NUL device on the specified floppy disk drive and deletes the dummy file \$\$TEST\$\$.\$\$\$ if successful. (You can't use an environment variable as an indicator, because the test is being done in a secondary command processor.) I've tested this successfully with DOS 3.3 and 6.2. I suspect it will work on any DOS version that responds with the newer "Fail"

message. This approach is much more graceful than requiring the user to interpret the "Abort, Retry, Fail?" message.

Thomas G. Lavedas
Clifton, Virginia

► **PC MAGAZINE:** The IF EXIST test will almost always return true when applied to the NUL device, unless an unavailable drive or directory is specified. If DRVREADY.BAT (Figure 1) successfully finds NUL in the root directory of the specified drive, then that drive is ready for use. Because the test is being performed under a secondary command processor, DRVREADY.BAT can't use an environment variable to signal success. Any such variable would disappear on return from the secondary command processor. Instead, DRVREADY creates a dummy 0-byte file and deletes that file only if the drive is ready.

I modified DRVREADY.BAT to take a drive letter as its single parameter. The line immediately following the initial @ECHO OFF checks to make sure that there is one command line parameter. The next line is yet another application of the amazing FOR command. When an item in the FOR command's list begins with a slash, it gets processed as two items: the first character and the remainder. If you pass BEE to DRVREADY.BAT instead of B, for example, the FOR command will split it into B and EE. Neither of these is

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```
@ECHO OFF
IF '%1'=='' GOTO BAD_PARAM
FOR %v IN (/%1) DO IF NOT %v==%1 GOTO BAD_PARAM
:TEST_DRIVE
  REM>$$TEST$$.$$$
  %COMSPEC% NUL /F /C IF EXIST %1:\NUL DEL $$TEST$$.$$$
  IF NOT EXIST $$TEST$$.$$$ GOTO DRIVE_READY
  DEL $$TEST$$.$$$
  ECHO Please put a disk in drive %1: and press a key when ready...
  PAUSE>NUL
GOTO TEST_DRIVE
:DRIVE_READY
ECHO Drive %1: is ready.
GOTO End
:BAD_PARAM
ECHO SYNTAX: "%0 d", where d is a drive letter
:End
```

Figure 1: DRVREADY tests the drive letter passed on its command line to see if a disk is in the drive.




```
@ECHO OFF
REM DRVLIST.BAT - lists available drive letters
IF NOT '%1'==' ' GOTO TEST_DRIVE
SET Drives=
ECHO Checking for drives a: through z:...
FOR %%v IN (a b c d e f g h i j k l m n o p q r s t u v w x y z) DO CALL %0 %%v
ECHO Available disk drives: %Drives%
GOTO End

:TEST_DRIVE
REM>$$TEST$$.$$$
%COMSPEC% NUL /F /C IF EXIST %1:\NUL DEL $$TEST$$.$$$
IF NOT EXIST $$TEST$$.$$$ SET Drives=%Drives% %1:
IF EXIST $$TEST$$.$$$ DEL $$TEST$$.$$$
:End
```



Figure 2: DRVLIST.BAT uses the technique introduced in DRVREADY.BAT to compile a list of all available disk drives.

equal to BEE, so the batch file will jump to the label BAD_PARAM. Only a single-letter parameter will get past this test.

This is an ingenious solution to a problem that comes up in any batch file dealing with floppy disk drives, but it has other applications as well. Figure 2 is a batch file that checks what drives are available on the system. It simply applies the drive-ready test to each possible letter from a to z. DRVLIST.BAT fills an environment variable with the list of drives. An INSTALL batch file might use this information to present the user with a list of possible drives for the installation.

You can download both batch files from PC MagNet's Utilities/Tips Forum archived as DRV.ZIP.

Take Control of The Control Panel

If you frequently need to use a specific Control Panel applet, you can launch that applet directly from an icon in a Program Manager group. For example, to start the Printers applet without first launching the Control Panel, create a new program item and specify Control Printers as the Command Line.

When you double-click on this new program item, the Control Panel starts and immediately opens the dialog box for the Printers applet. When you close the Printers dialog box, the Control Panel quits also. You can even use the same Printers icon that appears in Control Panel by retrieving it from the WINDOWS\SYSTEM\MAIN.CPL file.

Wayne Hausmann
Austin, Texas

► **PC MAGAZINE:** To choose an icon from Control Panel's set, here's what you do. After you've filled in the command line and description lines for your new program item, press the Change Icon... button. In the Change Icon dialog box, enter system\main.cpl for the filename. Now just pick a standard Control Panel icon from the list. If you're creating a fast-access icon for an add-on applet, simply use the name of the corresponding .CPL file rather than MAIN.CPL.

Using this tip, you don't have to double-click the icon you want after waiting for the Control Panel to load, but you still have to wait for the Control Panel to load. You can speed up this process by suppressing applets that you rarely use. Here's how: Open CONTROL.INI in the Windows Notepad or your favorite text editor and look for the section heading [Don't Load]. If you don't find this heading, create it at the end of the file (include the square brackets). Now launch the Control Panel and examine the numerous applets it offers. For any applet that you use rarely, type the applet name on a line below the [Don't Load] section header, followed by an equal sign and any text whatsoever—for example,

```
[Don't Load]
Keyboard=1
International=Yes
Drivers=No
Mouse=Mister Potato Head
```

Close the Control Panel and open it again; the applets listed under [Don't Load] are gone! On the rare occasion that you need to run one of the suppressed applets, just open CONTROL.INI and delete that applet's line from the [Don't Load] section.

Combine this with the loading speed gained from Mr. Hausmann's direct-access method, and you've got super-fast access to the applets you use most.

A Secret DOS Switch

I use DOS 6.2 and I recently stumbled across a command line switch that I didn't know existed. That switch is the comma. So far it seems to work with two commands, though there may be more.

The first command is DIR. Using the comma switch immediately after DIR reveals hidden files and directories. Thus, DIR, executed in the root directory shows IO.SYS and MSDOS.SYS (and any other hidden files and directories that might exist). If you're in the computer-security field and have to know what illegal software exists on a computer, this is an easy way to find those skeletons in the closet.

The second command is ATTRIB .EXE. The comma switch placed immediately after this command strips all attributes from the files processed. No more typing ATTRIB -R -A -S -H to rid files of their attributes!

Rodrick S. Adams
Havelock, North Carolina

► **PC MAGAZINE:** It's amazing that we can still find undocumented switches for DOS commands! The comma switch with DIR works in DOS versions starting with 5.0. Not coincidentally, DOS 5.0 also introduced DIR's /A switch, which displays all files regardless of attributes. DIR followed by a comma is equivalent to DIR *.* /A, so you can't limit the listing to files matching a certain file specification when you use the comma switch. If you need to see a particular subset of files regardless of their attributes, use the /A switch—for example, DIR C:*.SYS /A.

ATTRIB's comma switch works in DOS versions 4 and later. In DOS 4.0, however, the ATTRIB command has no control over the hidden and system attributes, so in that version, the comma switch will not clear those attributes. Starting in DOS 5.0, this switch is truly useful for clearing all attributes from a group of files—much faster and easier than typing out ATTRIB -R -A -S -H. □

Tutor

BY JEFF PROSISE

Fractals and Data Compression

Of all the different images that a computer can create, few can rival fractals for sheer beauty and the ability to inspire awe in the mind of the observer. A fractal image possesses infinite complexity. No matter how far you zoom in, details continue to cascade. Examples of fractal objects are abundant in nature: an endlessly zigzagging coastline, the infinitely undulating surface of a mountain range. The universe itself has fractal characteristics. Look closely enough and you'll discover the atoms that make it up and perhaps the subatomic matter from which atoms are composed.

The most famous fractal of all is one generated by a computer: the Mandelbrot set, named after Benoit Mandelbrot, the mathematician who coined the word *fractal* in 1975. Mandelbrot discovered that by plotting certain points in the complex plane, he could generate a very abstract-looking image, the Mandelbrot set (see Figure 1).

The complex plane is like an ordinary x,y graph except that it contains both real and imaginary numbers—numbers containing a term called *i*, which represents the square root of negative 1. Real numbers are plotted on the x-axis, and imaginary numbers on the y-axis.

The Mandelbrot equation takes a point in the complex plane and returns another point. It is applied iteratively: The output from the first point's coordinates are next used in the equation, the output from that are used in the next equation, and so on. The group of points produced by this iteration is called the *orbit* of the starting point. If the magnitude (the distance from the origin) of the

points in the orbit continually increases, we say the orbit "escapes to infinity," and the corresponding point is not a member of the Mandelbrot set. If, however, the orbital points' coordinates don't exceed a certain value, then the point is a member of the set. Because the Mandelbrot set is a fractal object, no matter how far you zoom in on a region of the complex plane near the set's edge, you'll get an equally detailed image.

For most of us, the word *fractal* conjures up visions of swirling patches of color that form intricate, detailed patterns. These images are usually formed using escape-time fractals, of which the Mandelbrot set is one example. In the case of the Mandelbrot set, the different colors come from assigning each pixel a color that reflects the number of orbital points that were calculated before a certain value was exceeded. Hence the term *escape time*: Color is indicative of the time (or number of points) required for the pixel's orbit to escape a predetermined numerical limit. In the escape-time image in Figure 1, the Mandelbrot set is the black part in the center; the colored regions lie outside the Mandelbrot set. Dense patterns of color identify unstable regions of the fractal, where small changes in input produce large changes in output, while smooth, flowing regions of color identify relatively stable areas. Escape-time fractals are useful for more than just making pretty pictures. Among

other things, they are used to model the behavior of chaotic dynamic systems such as weather patterns.

IFS FRACTALS A potentially more useful yet lesser known type of fractal is the Iterated Function System (IFS) fractal. Invented by fractal guru Michael Barnsley and his colleagues at Georgia Tech, the IFS approach to fractal imaging exploits self-similarities in an image by modeling a picture as several smaller pictures of itself. Special equations known as *affine maps* allow regions of the image to be translated, rotated, and scaled; these regions therefore serve as building blocks for the rest of the picture. One of the most striking (and famous) IFS images is that of a black spleenwort fern, in which each frond is actually a miniature version of the fern itself (see Figure 2). Though generated by a computer using affine maps, the fern appears quite real. In fact, it's been suggested that nature uses something analogous to an IFS fractal to encode the genetic makeup of plants and trees.

IFS fractals have one very real and useful application: They can be used to compress large bitmap images to fractions of their normal sizes. Image compression is one of the hot topics in computer graphics today, because images must be compressed so that computers can achieve the bandwidth necessary for real-time video playback. Like JPEG, IFS image compression, often referred to simply as

Fractals are useful for more than just making pretty pictures: They can compress large bitmap images to fractions of their normal sizes.

fractal image compression, is a lossy technique, meaning that the uncompressed image may not match the original image pixel for pixel. But whereas a 50-to-1 compression ratio is quite good for JPEG and similar compression methods, IFS image compressors frequently achieve ratios upwards of 10,000 to 1. Mr. Barnsley's company, Iterated Systems, sells a function library that programmers can use to compress and decompress images using the IFS method. Microsoft Encarta uses this library to compress images stored on CD-ROM, as do other commercial software products.

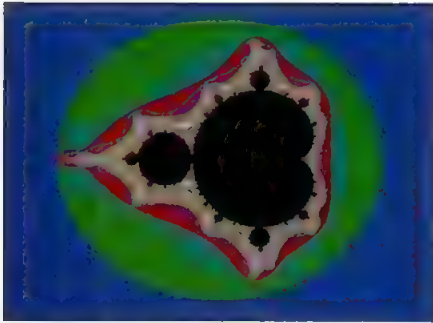


Figure 1: The Mandelbrot set is probably the best known fractal. This view of the Mandelbrot set was produced by the Stone Soup Group's freeware program, FRAGTINT.

To help you better understand fractal image compression, I'm going to show you how an IFS fractal fern is generated using a simple program written for DOS's QBasic. Then we'll see how the procedure can be generalized to compress and decompress graphics images.

THE IFS FERN The heart of the IFS fern is the affine map defined by the matrix equation

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} e \\ f \end{bmatrix}$$

Here x and y are the coordinates of a point input to the equation, x' and y' (x prime and y prime) are the coordinates of a point output from the equation, and a , b , c , d , e , and f are coefficients of the equation. If you're unfamiliar with linear algebra, this equation probably means very little to you. Fortunately, the rules of matrix addition and multiplication let us write the equations for x' and y' in a simpler form:

$$\begin{aligned} x' &= ax + by + e \\ y' &= cx + dy + f \end{aligned}$$

What these equations really represent are a means for a computer to generate the coordinates of a new point—(x' , y')—from the coordinates of another—(x , y).

The IFS fern actually uses not one but four affine maps. The matrix equations of the four affine maps are identical except for the values of a , b , c , d , e , and f . These values are shown in Figure 3. Each affine map is also assigned a probability from 0.0 to 1.0 that quantifies its importance in relation to the other maps; these probabilities are also listed in Figure 3. Together,

these equations and probabilities constitute the IFS code for a fractal fern.

Given the parameters for this IFS code, generating an image of a fern is simple. First you pick seed values for x and y (0 and 0 do nicely). Then you plug those seed values into any one of the affine maps. The output from this equation is another set of x and y values (x' and y'), which you plot as a pixel on the screen. Do this several thousand times, each time using the x and y values output from the last iteration as input to the next iteration. The image shown in Figure 2 will gradually coalesce on your screen.

Where do the probabilities figure in? Over the course of several thousand iterations, each affine map should be used a number of times proportional to its assigned probability. In other words, equation 1 should be used 1 percent of the time, equation 2 should be used 85 percent of the time, and equations 3 and 4 should be used 7 percent of the time each. An equation should be selected at random in every iteration, but on the average, the probabilities should govern the number of times that each equation is selected.

To demonstrate this for yourself, type QBasic to start up DOS 5.x's or 6.x's QBasic and type in the short program listed in Figure 4. You can also download ISFERN.BAS from the Tutor section of PC MagNet's Utilities/Tips Forum. When executed, the program will reproduce the fern shown in Figure 2. It uses a WHILE:WEND loop to generate points repeatedly until a key is pressed, so to stop the program and return to QBasic, just press a key. The longer you let the program run, the more complete the image will become. What starts out as a few seemingly random points scattered about the screen will slowly grow into a computer-generated replica of a fern.

There are a couple of aspects of ISFERN.BAS that I should point out. First, the program uses the statement SCREEN 12 to switch to 640-by-480 VGA graphics mode right after start-up. Because of this, it requires a VGA video adapter or equivalent. Second, it defines a viewport that encompasses the entire screen (VIEW (0, 0)-(639, 479)) and maps to that view-

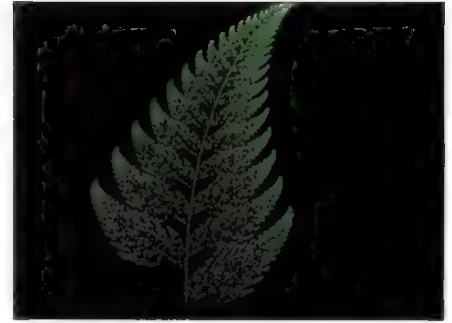


Figure 2: This fern fractal is an Iterated Function System fractal produced by the program in Figure 4. Notice how each frond is a smaller version of the entire fern.

port a logical coordinate system that ranges from 4 to 6 in the x direction and 0 to 10 the y direction. The values produced by the affine maps generally lie within this range, so this is an easy way to enlarge the fern to fill the screen. If you don't have a VGA adapter, modify ISFERN by changing the SCREEN 12 statement to one that is compatible with your video hardware and change the (639, 479) in the VIEW command to reflect the maximum screen extents in the selected video mode.

Also note that ISFERN uses QBasic's built-in random-number generator to calculate a new, random value of r each time through the loop. That value is then used to select one of the four sets of coefficients. Assuming the random-number generator produces a reasonably even distribution of random numbers (which it apparently does), then over the course of thousands of cycles, each set of coefficients—each affine map—will be used a percentage of times that corresponds to its assigned probability.

It is difficult to attach physical significance to the values of the coefficients in the affine maps, but you can learn much from some simple experimentation. For example, changing the values of b and c in the second equation to 0.06 and -0.06, respectively, increases the curvature of the fern's stem. As you might expect, changing them to 0.02 and -0.02 decreases the curvature. You can also learn something about the ef-

	a	b	c	d	e	f	Probability
Equation 1	0.00	0.00	0.00	0.16	0.00	0.00	0.01
Equation 2	0.85	0.04	-0.04	0.85	0.00	1.60	0.85
Equation 3	0.20	-0.26	0.23	0.22	0.00	1.60	0.07
Equation 4	-0.15	0.28	0.26	0.24	0.00	0.44	0.07

Figure 3: This is the IFS code for the fern image shown in Figure 2.


```

' Switch to graphics mode and initialize the screen.
SCREEN 12
VIEW (0, 0)-(639, 479)
WINDOW (-4, 0)-(6, 10)

' Seed the random number generator and initialize x and y.
RANDOMIZE TIMER
x = 0
y = 0

' Start the loop.
WHILE INKEY$ = ""

' Assign values to a, b, c, d, e, and f based on the probabilities
' of the affine maps used to generate the fern.
r = RND

```

```

IF (r <= .01) THEN
    a = 0: b = 0: c = 0: d = .16: e = 0: f = 0
ELSEIF r > .01 AND r <= .06 THEN
    a = .85: b = .84: c = -.04: d = .85: e = 0: f = 1.6
ELSEIF r > .06 AND r <= .93 THEN
    a = .2: b = -.26: c = .23: d = .22: e = 0: f = 1.6
ELSE
    a = -.15: b = .28: c = .26: d = .24: e = 0: f = .44
END IF

' Calculate new values for x and y and plot them on the screen.
newx = (a * x) + (b * y) + e
newy = (c * x) + (d * y) + f
x = newx
y = newy
PSET (x, y), 2

' Loop until a key is pressed. Then restore the screen to
' text mode and terminate.
WEND
SCREEN 0

```



Figure 4: This short QBasic program, IFSFERN.BAS, produces an image of an IFS fern.

fect that any one of the affine maps has on the fern-generation process by lowering its probability to 0. If you eliminate the first equation by commenting out the first IF statement and the following statement (changing the first ELSEIF to IF so that the program remains syntactically correct), the fern will lose its stem. Other changes produce equally intriguing results.

In fact, massaging the numbers in just the right way produces other IFS images. To see what I mean, modify the program in Figure 4 to enact the IFS code shown in Figure 5. Note that this fractal uses three affine maps not four. Also modify the WINDOW command to read WINDOW (-5, 0)-(2, 2.5). Now run the program and see what transpires.

It is also difficult to explain why the program works. That this trivial QBasic program can produce an image so striking is a surprise indeed. The key, of course, is the concept of self-similarity. Each affine map plays a role in describing an object that is best described in terms of itself. Through a series of translations, scaling operations, and rotations, the maps transform the last set of point coordinates into the coordinates of another point that lies somewhere on the object. Apply the affine maps enough times in a sufficiently random order, and the resulting image will picture the very object that the IFS code describes.

IFS IMAGE COMPRESSION Now are you beginning to see how IFS image compression works? Take a look at the fern in Figure 2. It contains thousands of pixels. If you stored the entire 640-by-480 screen as an uncompressed bitmap image—PCX or

.BMP format, for example—you'd have a graphics file more than 38,000 bytes in length (307,200 pixels requiring 1 bit, or one-eighth of a byte, per pixel). To store it in fractal form, you need only enough bytes to store the IFS codes—the four sets of coefficients and their probabilities. Assuming each floating-point number requires 4 bytes of storage space (a typical figure for single-precision floating-point data types), 112 bytes is all you need to store everything an IFS decompression program needs to recreate the fern. That's a compression factor of about 340 to 1! Imagine if every file on your hard disk could be squeezed down to 1/340 of its normal size. A 10MB hard disk would be enough for anyone, because it would offer the equivalent of about 3.5GB of storage space.

That's the principle behind IFS image compression: reduce an arrangement of pixels into a few numbers representing affine transformations. The hard part is, of course, guessing the numbers. Michael Barnsley and Alan Sloan have discovered a way to do this that works with any bitmap image, even one that doesn't exhibit obvious self-similarities. All the details of the method have not been made public, but the fact that Microsoft Encarta uses the Barnsley compression library is evidence enough that it works and is generically applicable to images of all types.

	a	b	c	d	e	f	Probability
Equation 1	0.05	0.00	0.00	0.50	0.00	0.00	0.33
Equation 2	0.50	0.00	0.00	0.50	1.00	0.00	0.33
Equation 3	0.50	0.00	0.00	0.50	0.50	0.50	0.34

Figure 5: This is the IFS code for a mystery fractal.

What we do know about the Barnsley-Sloan method is that it divides an image into irregularly shaped segments using standard image-processing techniques such as edge detection and texture-variation analysis. Then it computes a series of transformations defining the image as a union of these segments and records the transformations as IFS codes. An iterative process like the one used to draw the fern will then reconstruct the image with a surprising degree of accuracy. The number of affine maps isn't fixed at 4; some encoded images may use 100 affine maps or more.

The downside to fractal image compression is that it is extremely computation-intensive, much more so than JPEG. Decompression is faster, but it too requires more time than JPEG decompression. In the absence of specialized compression/decompression hardware, the IFS method is suitable for static images but only marginally useful for video.

FURTHER READING To learn more about IFS fractal image compression, read Barnsley and Sloan's article "A Better Way to Compress Images" in the January 1988 issue of *Byte*. This article succinctly and completely discusses IFS codes. Also see Barry Simon's article "How Lossy Compression Shrinks Image Files" in our July 1993 Lab Notes. For general fractal information, see Dick Oliver's *FractalVision*,

from Sams Publishing, and the freeware program FRACTINT, available on many graphics BBSs, including CompuServe's COMART Forum. □

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could do all that

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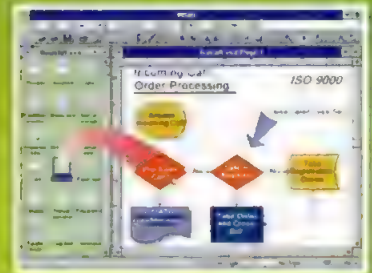
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Business drawing for people whose business isn't drawing

Extending Your Apps

BY BRIAN PROFFIT

Tuning Your DOS Applications Under OS/2 3.0

In the last column we touched on several general ways to boost the performance of DOS and Windows applications running under Personal OS/2, which IBM has since renamed OS/2 3.0. We then homed in on improving performance by changing the four Windows-related Win-OS/2 settings (for more information, see the issue of September 27, 1994). This time, I'll cover the DOS settings that most directly affect the performance of an application (or applications) running in a DOS session. Since Windows runs on top of DOS, though, nearly all of these parameters affect both types of programs.

To change a program's settings, click on its icon with the right mouse button (or the left one if you've reconfigured OS/2 for southpaws). Choose the arrow next to the Open selection on the menu that pops up. On the secondary menu, select Settings. When the Settings Notebook opens, click on the right arrow at the bottom of the dialog to go to page two. Once there, press the Settings button to bring up the list of changeable settings (see Figure 1).

- **COM_DIRECT_ACCESS** (default Off): OS/2 keeps programs from accessing hardware directly so that simultaneously executing applications can't use the same device at the same time. Although this adds a layer of management, it often improves application performance by helping to buffer data transfers, so you're generally better off with the default setting. The extra layer can throw off the timing of some communications software, however,

so turn this setting on if your comm package has trouble maintaining a connection.

- **DOS_AUTOEXEC** (default C:\AUTOEXEC.BAT): The batch file you designate here will execute when the session opens. This lets you pull TSRs out of your AUTOEXEC.BAT and put them into special batch files for use in those sessions that specifically require the TSRs (so they won't take up memory in all of your DOS sessions).

- **DOS_BACKGROUND_EXECUTION** (default On): OS/2's strong multitasking is a big advantage—when the background applications perform useful work. Many DOS applications, however, assume that they have total control of the

computer. Rather than going to sleep and waiting for a keystroke to wake them up, they constantly check the keyboard buffer for user input. This technique, called polling, can really slow the system down. Changing this setting to Off causes the DOS session to be suspended when switched to the background, preventing wasted processor time when you are not actively using this program. That setting makes sense for most but not all programs. You don't want to suspend communications programs, since downloading files in the background is a real bonus. Changing this setting to Off will also dis-

able DDE (Dynamic Data Exchange) with Windows applications.

- **DOS_BREAK** (default Off): Pressing Ctrl-C or Ctrl-Break is a quick way to interrupt DOS programs. DOS users discovered a long time ago, though, that the operating system continually checking to see whether these keys were pressed could slow things down. Since OS/2 lets you quickly close DOS sessions via the Window List (press Ctrl-Esc or both mouse buttons simultaneously), there's almost no reason to turn this setting on.

- **DOS_DEVICE** (default based on CONFIG.SYS): Under DOS and Windows, all your device drivers must appear in CONFIG.SYS, so they consume memory whether you use them or not. This setting lets you specify only the drivers needed by a particular application, so drivers tie up no system memory unless you run the program that requires them. Even when that program runs, though, other DOS and Windows sessions retain their full memory allotments.

By default, this setting contains all DOS device drivers in CONFIG.SYS.

Here's an explanation of the DOS settings that most directly affect the performance of an application running in a DOS session.

You can add new drivers here and remove any not specifically required for this session. It is best to keep the number of drivers in CONFIG.SYS to a minimum and add them only to those sessions that require them.

- **DOS_FILES** (default 20 for DOS programs, more for Windows programs; range

20 to 255): This statement corresponds to the FILES statement in CONFIG.SYS and refers to the number of file handles available to this DOS session. Raising the value takes memory from DOS, but setting it too low is a common cause of DOS and Windows application crashes. Check the application's documentation for the recommended FILES value.

Some packages require a large value for FILES. WordPerfect 6.0a for Windows, for example, suggests 100! Occasionally, a program's installation routine will raise the FILES setting in your CONFIG.SYS. That new value will apply to every DOS session,

including those that would be perfectly happy with the default size. DOS forces you either to accept the decrease in memory for all your programs or to change the CONFIG.SYS and reboot every time you use a different application. Under OS/2, though, you can and should leave FILES at its default in CONFIG.SYS. Use DOS_FILES in the settings notebook to make the change only for sessions that specifically require it.

- **DOS_HIGH** (default Off): A few applications require DOS to be in conventional memory, because they access some of DOS's internal structures directly. OS/2, therefore, opts for maximum compatibility rather than maximum power. The vast majority of applications (particularly current versions), however, allow the user more flexibility in configuring memory. Even under native DOS, most people now have DOS=HIGH in CONFIG.SYS to maximize available conventional memory. Changing this setting to On will free about 26K of conventional memory and rarely cause compatibility problems.
- **DOS_LASTDRIVE** (default Z): This parameter determines the last drive letter available to DOS programs. Since each letter requires about 100 bytes of memory, you can save roughly 2K by changing this setting to E (if your program doesn't use logical drives or a CD-ROM beyond that letter). That may not sound like a huge savings, but it can make the difference between running an application and an out-of-memory error.

Network users may need to access drives up to Z:, but remember that OS/2 gives you the luxury of specifying a different LASTDRIVE for each DOS session, so you can still free up this space for local programs.

- **DOS_RMSIZE** (default 640, range 128 to 640): This setting lets you decrease the memory available to a DOS session. *What?* When you're trying to squeeze out every possible byte as it is?

You have to think a little differently when using OS/2. Each open DOS session takes up memory. When you have several open but don't have much physical memory, OS/2 may be swapping to disk often. Lower this setting for a DOS program

that requires little memory, and you'll free up storage for everything else. You might even decrease swapping, improving the performance of all the programs you're running.

- **DPMI_DOS_API** (default Auto; set-

■ Getting Set for Games

DPMI_MEMORY_LIMIT8
HW_ROM_TO_RAMOn
HW_TIMER.....On
IDLE_SECONDS5
IDLE_SENSITIVITY90
INT_DURING_IO.....On
VIDEO_8514A_XGA_IOTRAPOff
VIDEO_RETRACE_EMULATION ...Off
VIDEO_SWITCH_NOTIFICATION ...On

Games and multimedia applications have special needs. As a starting point, consider the above setting changes from the defaults.

tings Enabled, Disabled, or Auto): Starting with the 80286, Intel microprocessors incorporated a protected mode in which many tasks, including memory management, were handled differently. Software lagged behind for quite awhile, providing no way to exploit the power of this new feature. OS/2 was written specifically to use it, but DOS needed an add-on, so the DOS Protected Mode Interface (DPMI) was created.

The default setting directs OS/2 to watch the DOS program for attempts to execute a DPMI instruction, which OS/2 then translates into a standard DOS instruction. If your program doesn't use DPMI, you may get a marginal performance improvement by changing this setting to Disabled. Enabling it can benefit programs that require DPMI, such as Borland's C, C++, Turbo C, and Paradox and Microsoft C/C++ 7.0 Linker. If you aren't sure whether your programs use DPMI, it's usually safe to leave the default value of Auto.

- **DPMI_MEMORY_LIMIT** (default 4, range 0 to 512): This determines the amount of memory (in megabytes) allocated for applications that use DPMI memory management (if DPMI_DOS_API is not disabled). Before Version 2.1, OS/2 would allocate all the spec-

ified memory upon starting the application, causing a lot of unnecessary swapping and a corresponding performance loss. With 2.1, though, DPMI memory is given out only when the program specifically requests it, so there's less of a penalty from raising this value. Doing so can really speed up large DPMI applications. Still, raising this parameter too high can increase swapping, which will slow down all your programs.

- **DPMI_NETWORK_BUFF_SIZE** (default 8, range 1 to 64): Network-specific Windows programs use a buffer to help manage the flow of data across the network. You can set the buffer size (in kilobytes) here. There's no significant penalty to bumping this up, so try raising it if you're having problems with a Windows network program.

- **EMS_MEMORY_LIMIT** (default 2048, range 0 to 32768): This setting controls the maximum amount of memory (in kilobytes) that OS/2 will allocate to this session for use as EMS memory. A program that needs EMS memory (the documentation should tell you) may run faster if you raise this setting above the 2M default. If you're low on physical memory and doing a lot of swapping, though, increasing this value can slow down this session and all others. Still, if you aren't running many programs in the background, a large swap file doesn't make much difference, since the program you're actively running can stay in physical memory. You will notice a delay, however, when you switch to a different session.

- **HW_ROM_TO_RAM** (default Off): Before you ever load an operating system, your computer has software in it. The low-level instructions required to interface with the computer's devices are stored in ROM, which maintains its contents even when the power is turned off. ROM is slower to read than RAM, though. Changing this setting to On lets OS/2 copy the contents of ROM into RAM, speeding up programs in the session. This really doesn't penalize you, so always change this setting to On unless your application's documentation says that you shouldn't.

- **HW_TIMER** (default Off): Programs use your computer's timer chip for more than timing events. They also use it to determine the processor's speed—an important consideration for programs such as games that need consistent speed regard-

Extending Your Apps

less of the hardware. An arcade game that runs well on a 25-MHz 386 could be too fast to see on a 66-MHz 486 unless the program adjusts itself. Since OS/2 tries to prevent programs from accessing hardware directly, however, the default is Off for this setting, and a simulated timer is substituted for the real one.

Some applications run faster if they can access the timer directly, but others will no longer work properly because of timing differences between the program and the operating system. Also, programs may conflict with each other if more than one tries to use the timer simultaneously. Still, it doesn't hurt to turn this setting to On and see if performance improves for your particular application. If programs running in this session encounter problems, this is one of the first settings you should change back to the default.

- **IDLE_SECONDS** (default 0, range 0 to 60), **IDLE_SENSITIVITY** (default 75, range 0 to 100): OS/2 has built-in intelligence that tries to prevent a DOS program that's polling the keyboard from slowing down the rest of the system. The OS/2 scheduler allots processing power to programs according to a three-tier priority scheme. After a certain period, a DOS program gets dropped to a lower tier if it does nothing more than what appears to be polling. This frees some of the processor's time for other, more productive tasks.

Usually, that's what you want. Some programs, though, exhibit the characteristics of polling when they're actually doing other tasks that you don't want moved to a lower priority. A video game, for example, will often appear to be simply waiting for user input when it's actually performing graphics scrolling. The scrolling suddenly slows to a crawl as OS/2 drops the game's priority. And word processors are notorious for going into tight polling loops in an attempt to respond as quickly as possible to every key the user presses. **IDLE_SECONDS** establishes the length of time that a program must be perceived as polling before its priority is reduced. **IDLE_SENSITIVITY** determines the percentage of processor time that can be spent polling before a program's priority drops. If a DOS application slows the rest of the system, try lowering both settings—say, 1 second and 10 percent at a time. On the other hand, if your DOS program seems sluggish,

OS/2 might be drubbing it for idleness prematurely, so try raising both settings. If you raise these parameters, though, you should also set **DOS_BACKGROUND_EXECUTION** to Off so that when the program is in the background, it doesn't drain processing power. Applications that cause polling problems are usually less likely to be the type you want running in the background anyway.

Note that these settings affect the performance of DOS sessions and all other programs running at the same time.

- **INT_DURING_IO** (default Off): Programs under DOS don't receive interrupts while performing file writes, but OS/2 can handle both activities simultaneously. If you have multimedia applications that have to deal with additional interrupts from devices like sound cards

close the printer until they end. In other words, if you print a letter from your word processor, you might have to exit the application to force the document to print—clearly an unacceptable solution.

To get around the problem, OS/2 assumes printing has completed if it senses no printer output from a DOS program for the number of seconds specified in this setting. With a slow DOS program, OS/2 might prematurely conclude that printing has completed, causing your output to be divided into separate pieces (possibly with the text or graphics from other programs in between). Raising this setting will make OS/2 more patient with your program. If, on the other hand, you're pacing the floor waiting for your report to appear, you may need to lower this setting so that OS/2 responds more quickly when

the program stops sending output. The proper setting is mostly a matter of individual feel, so if you have a DOS program affected by this value, experiment until you get the setting the way you like it.

- **VDM_PRIORITY** (default 0, range 0 to 31): Another new setting for OS/2 3.0, this allows you to set the priorities of your DOS and Windows sessions individually. A higher priority gives a greater percentage of your computer's resources to this session (which lowers the percentage allocated to other programs running at the same time).

By the way, remember that OS/2 automatically gives a slight priority boost to the program currently in the foreground.

- **VIDEO_8514A_XGA_IOTRAP** (default On): This lucidly named setting determines whether OS/2 watches video output to 8514/A or XGA adapters. This is done to prevent some bizarre video glitches that can occur when you switch between full-screen and windowed sessions. The extra effort, however, takes processor time and can slow things down. If you don't use these boards, you can change this setting to Off without concern. Even with one of these adapters, though, you can still turn the setting off if you don't need to copy the screen contents to the clipboard, make sure **VIDEO_SWITCH_NOTIFICATION** is

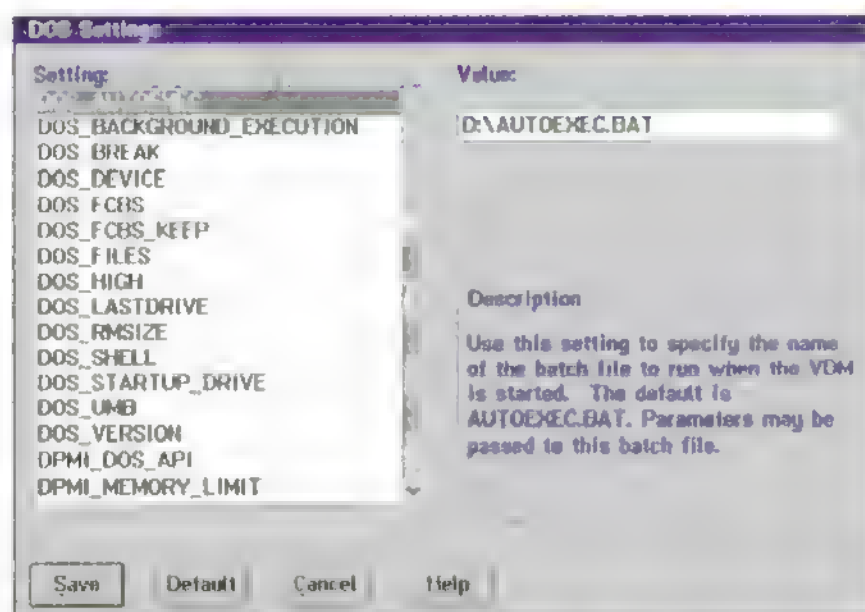


Figure 1: This shows the DOS settings you can change using the OS/2 Settings Notebook.

and CD-ROM drives or if you're having problems with sound breaking up in a DOS program, change this setting to On. Otherwise, leave the default, since the additional overhead of checking for interrupts can slow down disk operations.

- **PRINT_TIMEOUT** (default 15, range 0 to 3600): OS/2 has to be careful that programs do not all send output to the printer at the same time. You wouldn't enjoy seeing one line from your word processor followed by part of a database report then a row of a spreadsheet. To prevent this, OS/2 intercepts information headed for the printer and stores it in a temporary file—a process called *spooling*. When the program closes the printer (indicating it has no more to write), the output goes to the physical print device. DOS programs, however, assume no other programs are running, so they often don't bother to

On, and don't run this session in a window (run it full screen only).

- **VIDEO_FASTPASTE** (default Off): One of OS/2's advantages is its ability to let you cut and paste between DOS and OS/2 applications, as well as among applications of the same type. DOS programs weren't written to accept pastes from the OS/2 clipboard, of course, so they have to be fooled into thinking the text came from the keyboard. By default, this is done rather slowly (at about average typing speed) to avoid compatibility problems.

Changing this parameter to On causes the keyboard buffer to be loaded much more quickly, thus speeding up pastes into DOS applications. Some programs, however, use an internal keyboard buffer that can overflow if characters come in too quickly. If you're pasting into a DOS application, always try turning this setting on to speed things up. Simply turn the parameter to Off again if text is pasted incorrectly.

Note that this setting applies only to DOS programs. Windows applications use the Windows Clipboard for paste operations.

- **VIDEO_ONDEMAND_MEMORY** (default On): This setting pertains only to full-screen DOS sessions. The default causes OS/2 to allocate enough memory when the session opens to hold the screen's contents if the session goes into high-resolution graphics mode. This can take a great deal of memory—especially if your video adapter supports high resolutions. In low-memory situations, this can cause a large increase in the swap file, an associated delay in getting the session started, and, of course, a performance hit to all other programs running.

If the program in this session won't use high-resolution graphics, you can speed up this session and all others by changing the setting to Off. In fact, you can still use high-resolution graphics; the memory is allocated only when the program requires it rather than when the session begins.

The only reason not to leave this setting Off for all sessions is in extremely tight memory situations. If you run out of memory and swap space, the session may freeze when it tries to switch into graphics mode. You would then have to close some other programs to free up memory before the DOS session could be used. This is rare, however, so I suggest leaving this setting at

Off for all sessions. If you do turn it to On, you should also change **VIDEO_SWITCH_NOTIFICATION** setting from its default Off to On to avoid a conflict that can cause the screen to go black.

- **VIDEO_RETRACE_EMULATION** (default On): Some older DOS programs perform behind-the-scenes gyrations to prevent the video snow that appears when writing to certain early CGA adapters. Although not a problem since the introduction of EGA boards, old DOS applications may still be carrying this baggage, which slows them down.

This setting lets OS/2 fool the DOS program into running more quickly by simulating the video signal the program keys on. A few of the older programs, however, may run more slowly under this emulation. Experiment

by turning this setting Off but be alert for session-switching problems. If any occur, turn the setting to On again.

- **VIDEO_ROM_EMULATION** (default On): The **HW_ROM_TO_RAM** setting copied the BIOS functions for disk activities from ROM to the faster RAM. This setting does the same for video BIOS functions, speeding up all video activities. Leave this parameter On in virtually all circumstances, unless you've purchased a special video ROM and use a program that relies on unique characteristics of that ROM. If that's the case, you'll know it.

- **VIDEO_SWITCH_NOTIFICATION** (default Off): Unless you change the defaults for the **VIDEO_8514A_XGA_IOTRAP** or **VIDEO_ONDEMAND_MEMORY** settings as described earlier, leave this setting at Off to avoid unnecessary screen redrawing, which can hurt performance.

- **VIDEO_WINDOW_REFRESH** (default 1, range 1 to 600): When a program writes to the screen, the output actually goes into a buffer from which the screen is periodically refreshed. This setting determines the interval (in tenths of a second) between refreshes. The default value provides the fastest refresh for this particular program. Still, you can experiment with

raising this value to try to improve performance, particularly for processor-intensive graphics applications.

- **XMS_HANDLES** (default 32, range 0 to 128): This setting controls the number of discrete extended memory blocks that can be allocated. If you're getting error messages related to extended memory, first raise the **XMS_MEMORY_LIMIT**. If that doesn't work or the application's documentation specifically requests a larger

number of handles, raise this setting. Otherwise, leave it alone, or you'll hurt performance by increasing memory usage (which increases swapping).

- **XMS_MEMORY_LIMIT** (default 2048, range 0 to 16384): This setting establishes the maximum amount of extended memory (in kilobytes) that OS/2 will give programs in

this session. The default of 2MB is enough for many applications, though you may find that some of your programs using extended memory can benefit from raising this limit.

Your application's documentation should tell you if it uses extended memory. If it doesn't, lower this setting to 0 to avoid wasted memory, unnecessary swapping, and system slowdown. (If you want to set **DOS_HIGH** to On, you need to allocate at least 64K of XMS memory.)

If you don't care to get to this level of detail, chances are your DOS and Windows programs will work just fine with the default values and even better with the values assigned by the Migrate Applications program. On the other hand, a good mechanic can always tweak the engine for a little extra horsepower.

Remember to change only one setting at a time and then check for effects. That makes determining which changes helped or hurt easy, and you're more likely to remember what the original setting was should you decide to change it back. □

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*Chances are your DOS
and Windows apps will
work with the defaults,
but a good mechanic can
always tweak the engine
for extra horsepower.*

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Toolkits

BY PETER G. AITKEN

Spell-Checking For Your Apps

Spell-checking is an important feature for any application that works with words, yet programming a spell-checker from scratch is a formidable task. Save yourself time and hassles with VT-Speller, Version 1.01, a \$99 tool that provides royalty-free spell-checking for Windows programs. The standard custom-control version can be used with Microsoft Visual Basic or other development tools that support Visual Basic custom controls, such as Microsoft Visual C++ or Borland C++. The package also includes a DLL version.

Even if you're used to the sophisticated spell-checkers in Microsoft Word or WordPerfect, you won't find VT-Speller lacking. VT-Speller can generate suggested replacements for misspelled words. Numbers and uppercase words can be ignored if this is desired. Performance can be tuned to increase speed at the expense of memory usage or to limit memory usage at the expense of speed.

YOUR DICTIONARY OR MINE?

At the heart of any spell-checker is its dictionary. VT-Speller comes with a 100,000-word American English dictionary that is stored in a compressed, indexed format for quick lookups. Spot checks turned up most of the words we looked for but not *pandemonium* or *sovereign*.

To fill the gap, users can create an unlimited number of custom dictionaries. There are two types: A compatible custom dictionary uses the Microsoft Word custom dictionary format, which is a sort of ANSI text file with one word per line. VT-Speller's proprietary extended custom dictionary format is an ANSI file that contains additional information such as syllable structure (which can be used by your program for hyphenation) along with the word list.

A conversion utility can convert both compatible and extended custom dictionaries to the VT-Speller's standard compressed and indexed format. The standard format has the advantage of smaller size and faster lookups but cannot be updated.

PROGRAMMING WITH VT-SPELLER

Using the custom-control version of VT-Speller is straightforward. Programming with the DLL version is a bit more complicated, but the functionality is essentially the same. The text to be checked is passed to VT-Speller a word at a time or in large blocks. The maximum block size is 65,535 characters, so longer documents must be passed in sections.

If you use the default settings, VT-Speller will display its AutoPopup dialog box when a misspelled word is found. AutoPopup suggests replacement words and offers the usual spell-check options (Ignore, Ignore All, Replace, Replace All, Options, Cancel, and Add to Dictionary). Replacement requests are handled automatically; your program need only incorporate the corrected text into the original document. To improve performance, you can limit the number of suggestions made for misspelled words.

This mode of operation is fine for most applications. You can, however, disable the automatic features and (using properties and events) take control of VT-Speller's operation. For example, instead of using the AutoPopup dialog box and auto-replacement feature, you can write your own dialog box and word-replacement code. The user is notified of a misspelled word or a hit on the ignore list, for example, by means of a return property value or an event.

The 145-page manual, which is also available as on-line help, provides complete information in some areas but is skimpy in others. For example, the chapter on using VT-Speller with Visual C++ is only 2 pages long. Likewise, information on how to use the DLL version with C, C++, and Microsoft Access applications needs improvement. Demonstration programs are included only for Visual Basic and Visual C++. Despite these minor shortcomings, VT-Speller is an excellent product that demonstrates the power of the component approach to programming.

► **VT-Speller, Version 1.01.** List price: \$99. Requires: 1MB hard disk space, Microsoft Windows 3.1 or later, development tool capable of accessing DLL functions or Visual Basic custom controls. Visual Tools Inc., 15721 College Blvd., Lenexa, KS 66219; 800-599-6500, 913-599-6500.

Circle 441 on reader service card

OFF THE STACK

● **Software FX's Chart FX, Version 2.0** for Windows, makes adding advanced charting capabilities to your applications easy. The toolkit comes in both VBX and DLL form, and it supports more than 18 different types of charts. Chart FX's unique interface is especially visual and easy to use. Interface features such as the Toolbar, PaletteBar, and PatternBar are available to both developers and end users. *Software FX Inc.; 407-998-2377.*

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● **Imagine Software** offers Imagine, Version 1.5, a Visual Basic custom control for incorporating imaging features into your applications. Imagine includes support for scanning, image cleanup, printing, annotations, form overlay, file management, error management, and Clipboard operations. Over 90 properties and a dozen events give you control over the imaging features. The price is \$129 for a single-user license. *Imagination Software Inc.; 301-503-6567.*

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Environments

BY CHARLES PETZOLD

Displaying Enhanced Metafile Images Accurately

The great thing about metafile images is that they can be stretched to any size and still maintain reasonable fidelity. This is because a metafile normally consists of a series of vector graphics primitives such as lines, filled areas, and outline fonts. Enlarging or compressing the image simply involves scaling all the coordinate points that define these primitives. Bitmaps, on the other hand, can lose vital information, because compression can result in dropping entire rows and columns of pixels.

Of course, in real life metafile compression is not entirely flawless either. We live with graphical output devices that have a finite pixel size. A metafile image consisting of many lines could start to look like an indecipherable blob when compressed. Also, area-filling patterns and color dithering may look odd at small sizes. And if the metafile contains embedded bitmaps or old-fashioned raster fonts, these can pose familiar problems.

For the most part, though, metafiles are freely scalable. This is most useful when dropping a metafile into a word processing or desktop publishing document. Generally, when you select a metafile image in such an application, you'll be presented with a bounding rectangle that you can grab with the mouse and scale to any size. The image will also have the same relative size when rendered on a printer.

Sometimes, however, arbitrarily scaling a metafile is not such a hot idea. For

example, suppose you have a banking system that stores facsimiles of account holders' signatures as a series of polylines stored in a metafile. Widening or heightening this metafile would make the signature look different. At the very least, you need to keep the images' aspect ratios constant.

While it may be fun to stretch a metafile image of a person's face into a fat face or a thin face, it's also helpful to know the correct aspect ratio of the image and maybe set a menu option in your word processing program to maintain the ratio while sizing the image. Some metafile images may make sense only at a specific metrical size. (Counterfeiters will appreciate this concept.) So let's see how to display a metafile image with accurate sizing.

THE ENHANCED METAFILE In recent installments of this column, we've looked at one of the newest metafile formats, the enhanced metafile format, which is supported under the Graphics Device Interface (GDI) of Microsoft Windows NT 3.1. From a programming perspective, you create a metafile device context by calling `CreateEnhMetaFile`. In this function, you can specify a filename for a disk-based metafile or use a `NULL` parameter for a memory-based metafile.

You then call other GDI functions to draw into the metafile device context. Calling `CloseEnhMetaFile` deletes the device context and returns a handle to the metafile. If you've created a disk-based metafile, you can then delete the metafile handle by calling `DeleteEnhMetaFile`.

Displaying a disk-based metafile requires a call to `GetEnhMetaFile`, which returns a handle to the metafile. You can then call `PlayEnhMetaFile` to render the metafile image on a real device, such as the video display or the printer. The first parameter to `PlayEnhMetaFile` is the device-context handle for the output device on which you want to render the image, the second parameter is the handle to the metafile, and the last parameter is a pointer to a `RECT` (rectangle) structure. That `RECT` structure indicates to GDI where to display the image within the destination device context. GDI will stretch the image to fit snugly within that rectangle.

In the sample programs shown previously, we created a metafile during the `WM_CREATE` message of a window procedure and then displayed it in the

Displaying a metafile image accurately—either in specific metrical sizes or at the correct aspect ratio—can be tricky. This column shows you how.

client area of the program during the `WM_PAINT` message. The size of the rectangle was based on the size of the client area—specifically, half the width and height of the client area and centered within it. Thus, as you resize the program's window, you effectively resize the image. This is concep-

tually very similar to resizing a metafile image within a word processing document (although we're letting Windows NT take care of the user interface).

Displaying a metafile image accurately—either in specific metrical sizes or at the correct aspect ratio—requires using size information in the metafile header and setting the rectangle structure accordingly. This can sometimes be a bit tricky, but I'll show you how to do it later in this column. To make this project a little more interesting, let's first try something we haven't done before: rendering a metafile on the printer.

```

/*-----
EMF.C -- NT Enhanced Metafile Demonstration Shell Program
(c) Charles Petzold, 1994
-----*/

#include <windows.h>
#include <string.h>
#include "emf.h"

extern void CreateRoutine (HWND);
extern void PaintRoutine (HWND, HDC, int, int);

LRESULT CALLBACK WndProc (HWND, UINT, WPARAM, LPARAM);

HANDLE hInst;

extern char szClass [];
extern char szTitle [];

int WINAPI WinMain (HANDLE hInstance, HANDLE hPrevInstance,
                    LPSTR lpszCmdLine, int nCmdShow)
{
    char    szResource [] = "EMF";
    HWND    hwnd;
    MSG     msg;
    WNDCLASS wndclass;

    hInst = hInstance;

    if (!hPrevInstance)
    {
        wndclass.style          = CS_HREDRAW | CS_VREDRAW;
        wndclass.lpfnWndProc    = WndProc;
        wndclass.cbClsExtra     = 0;
        wndclass.cbWndExtra     = 0;
        wndclass.hInstance     = hInstance;
        wndclass.hIcon          = LoadIcon (NULL, IDI_APPLICATION);
        wndclass.hCursor        = LoadCursor (NULL, IDC_ARROW);
        wndclass.hbrBackground  = GetStockObject (WHITE_BRUSH);
        wndclass.lpszMenuName   = szResource;
        wndclass.lpszClassName  = szClass;

        RegisterClass (&wndclass);
    }

    hwnd = CreateWindow (szClass, szTitle,
                        WS_OVERLAPPEDWINDOW,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        NULL, NULL, hInstance, NULL);

    ShowWindow (hwnd, nCmdShow);
    UpdateWindow (hwnd);

    while (GetMessage (&msg, NULL, 0, 0))
    {
        TranslateMessage (&msg);
        DispatchMessage (&msg);
    }

    return msg.wParam;
}

BOOL PrintRoutine (HWND hwnd)
{
    static char szMessage [80];
    static char szPrinter [80];
    BOOL        bReturn = TRUE;
    char        *szDevice, *szDriver, *szOutput;
    DOCINFO     di;
    HDC          hdcPrn;
    int          cxPage, cyPage;

    GetProfileString ("windows", "device", "...", szPrinter, 80);

    if ((szDevice = strtok (szPrinter, ", ")) &&
        (szDriver = strtok (NULL, ", ")) &&
        (szOutput = strtok (NULL, ", ")))
    {
        hdcPrn = CreateDC (szDriver, szDevice, szOutput, NULL);

        else
            return FALSE;

        if (hdcPrn == NULL)
            return FALSE;

        cxPage = GetDeviceCaps (hdcPrn, HORZRES);
        cyPage = GetDeviceCaps (hdcPrn, VERTRES);

        strcpy (szMessage, szClass);
        strcat (szMessage, ": Printing");

        di.cbSize      = sizeof (DOCINFO);
        di.lpszDocName = szMessage;

```

```

        di.lpszOutput = NULL;

        if (StartDoc (hdcPrn, &di) > 0)
        {
            if (StartPage (hdcPrn) > 0)
            {
                PaintRoutine (hwnd, hdcPrn, cxPage, cyPage);

                if (EndPage (hdcPrn) <= 0)
                    bReturn = FALSE;
            }
            else
                bReturn = FALSE;

            if (EndDoc (hdcPrn) <= 0)
                bReturn = FALSE;
        }
        else
            bReturn = FALSE;

        DeleteDC (hdcPrn);

        return bReturn;
    }

LRESULT CALLBACK WndProc (HWND hwnd, UINT message, WPARAM wParam,
                        LPARAM lParam)
{
    BOOL        bReturn;
    static int  cxClient, cyClient;
    HDC          hdc;
    PAINTSTRUCT ps;

    switch (message)
    {
        case WM_CREATE:
            CreateRoutine (hwnd);
            return 0;

        case WM_COMMAND:
            switch (wParam)
            {
                case IDM_PRINT:
                    SetCursor (LoadCursor (NULL, IDC_WAIT));
                    ShowCursor (TRUE);

                    bReturn = PrintRoutine (hwnd);

                    ShowCursor (FALSE);
                    SetCursor (LoadCursor (NULL, IDC_ARROW));

                    if (!bReturn)
                        MessageBox (hwnd,
                                    "Error encountered during printing",
                                    szClass, MB_ICONASTERISK | MB_OK);
                    return 0;

                case IDM_EXIT:
                    SendMessage (hwnd, WM_CLOSE, 0, 0);
                    return 0;

                case IDM_ABOUT:
                    MessageBox (hwnd, "Enhanced Metafile\n"
                                "Demo Program\n"
                                "Copyright (c) Charles Petzold, 1994",
                                szClass, MB_ICONINFORMATION | MB_OK);
                    return 0;
            }
            break;

        case WM_SIZE:
            cxClient = LOWORD (lParam);
            cyClient = HIWORD (lParam);
            return 0;

        case WM_PAINT:
            hdc = BeginPaint (hwnd, &ps);

            PaintRoutine (hwnd, hdc, cxClient, cyClient);

            EndPaint (hwnd, &ps);
            return 0;

        case WM_DESTROY:
            PostQuitMessage (0);
            return 0;
    }

    return DefWindowProc (hwnd, message, wParam, lParam);
}

```

Figure 1: EMF.C is the shell program for demonstrating the enhanced metafile.



PRINTING METAFILES Those of you who read *Environments* during the first half of this year will recall programs that demonstrated a number of enhanced graphics techniques available under Windows NT. These programs displayed various images in their client areas and also had menu items that let you print the images on your printer. I was able to keep the code bulk down to a reasonable size by using a shell program called NTGDI. This shell contained all the overhead normally involved in a Windows NT program, including the menu logic and printing code. The program-specific code was in another file in a function called *PaintRoutine*, which the shell program called during the *WM_PAINT* message.

I'm going to do something similar

```
/*-----
EMF.H header file
-----*/

#define IDM_PRINT    1
#define IDM_EXIT     2
#define IDM_ABOUT    3
```



Figure 3: EMF.H contains definitions of constants used in EMF.C and EMF.RC

here. The shell program that demonstrates several aspects of enhanced metafiles is called EMF and is shown in Figures 1 through 3. EMF.C is very similar to NTGDI.C but with one major difference: During the *WM_CREATE* message, EMF.C calls an external function called *CreateRoutine*. As we'll see, this function will create a metafile. As in

```
/*-----
EMF8.C -- Enhanced Metafile Demo #8
(c) Charles Petzold, 1994
-----*/

#include <windows.h>
#include <string.h>

char szClass [] = "EMF8";
char szTitle [] = "EMF8: Enhanced Metafile Demo #8";

void CreateRoutine (HWND hwnd)
{
    HDC      hdcEMF;
    HENHMETAFILE hemf;

    hdcEMF = CreateEnhMetaFile (NULL, "emf8.emf", NULL,
                               "EMF8\\EMF Demo #8\\");

    Rectangle (hdcEMF, 100, 100, 201, 201);

    MoveToEx (hdcEMF, 100, 100, NULL);
    LineTo   (hdcEMF, 200, 200);
```

```
/*-----
EMF.RC resource script
-----*/

#include "emf.h"

EMF MENU
{
    POPUP "&File"
    {
        MENUITEM "&Print",          IDM_PRINT
        MENUITEM SEPARATOR
        MENUITEM "E&xit",           IDM_EXIT
    }
    POPUP "&Help"
    {
        MENUITEM "&About...",       IDM_ABOUT
    }
}
```

Figure 2: EMF.RC is the resource script containing the definition of the program's menu.

NTGDI, EMF calls a function named *PaintRoutine* in two places: once during the *WM_PAINT* message and again in the *PrintRoutine* function in response to a menu command to print the image. To test this, use the EMF8 file shown in Figure 4. If you have Windows NT and the Win32 Software Development Kit installed, you can create EMF8.EXE by running *NMAKE EMF8.MAK* from a Windows NT command line. You can download all the source and make files as well as the executable from PC MagNet's Programming Forum archived as EMF9.ZIP.

The *CreateRoutine* function in EMF8.C creates a simple image (a rectangle with the opposite corners connected by lines) that I've used in some of the earlier programs. It displays this metafile in the *PaintRoutine* function. As in earlier sample programs, EMF8 uses the size of the client area to define the rectangle that GDI uses to display the image.

You can also select the Print option



from the menu to render the image on your printer. The size of the image is based on the printable area of the printer page. Because printers often have a much higher resolution than video displays, the ability to print a metafile is an important tool for testing our ability to render an image in a specific size. Let's try to do that now.

DRAWING A RULER The EMF9 file shown in Figure 5 creates a metafile image that makes the most sense when displayed in a specific size. The image is that of a ruler 6 inches wide by 1 inch high, complete with tick marks every 1/16 inch and the numbers 1 through 5 in a TrueType font.

To draw a 6-inch ruler, we need to know something about device resolution. The *CreateRoutine* function in EMF9.C begins by creating a metafile and calling *GetDeviceCaps* four times using the device-context handle returned from *CreateEnhMetaFile*. These calls obtain the width and height of the display surface in both millimeters and pixels.

This may sound a bit odd. The metafile device context is usually seen as a storage medium for GDI drawing commands. It's not a real device like a video display or a printer, so how can it have a width and height?

Well, as you may recall, the first parameter to *CreateEnhMetaFile* is known as the *reference device context*. GDI uses this to establish device characteristics for the metafile. If the parameter is set to *NULL* (as in EMF9), then GDI uses the video display as the reference device context. Thus, when EMF9 calls *GetDeviceCaps* using the metafile device context, it actu-

```
MoveToEx (hdcEMF, 200, 100, NULL);
LineTo   (hdcEMF, 100, 200);

hemf = CloseEnhMetaFile (hdcEMF);

DeleteEnhMetaFile (hemf);
}

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    HENHMETAFILE hemf;
    RECT          rect;

    rect.left  = cxArea / 4;
    rect.right = 3 * cxArea / 4;
    rect.top   = cyArea / 4;
    rect.bottom = 3 * cyArea / 4;

    hemf = GetEnhMetaFile ("emf8.emf");

    PlayEnhMetaFile (hdc, hemf, &rect);

    DeleteEnhMetaFile (hemf);
}
```



Figure 4: The EMF8.C file contains two functions that are called from the EMF shell program.


```

/*-----
EMF9.C -- Enhanced Metafile Demo #9
(c) Charles Petzold, 1994
-----*/

#include <windows.h>
#include <string.h>

char szClass [] = "EMF9" ;
char szTitle [] = "EMF9: Enhanced Metafile Demo #9" ;

void DrawRuler (HDC hdc, int cx, int cy)
{
    char    ch ;
    HFONT    hFont ;
    int      i, iHeight ;
    LOGFONT lf ;

    Rectangle (hdc, 0, 0, cx + 1, cy + 1) ;

    for (i = 0 ; i < 96 ; i++)
    {
        if (i % 16 == 0) iHeight = cy / 2 ;    // inches
        else if (i % 8 == 0) iHeight = cy / 3 ;    // half inches
        else if (i % 4 == 0) iHeight = cy / 5 ;    // quarter inches
        else if (i % 2 == 0) iHeight = cy / 8 ;    // eighths
        else                iHeight = cy / 12 ;    // sixteenths

        MoveToEx (hdc, i * cx / 96, cy, NULL) ;
        LineTo   (hdc, i * cx / 96, cy - iHeight) ;
    }

    memset (&lf, 0, sizeof (lf)) ;

    lf.lfHeight = cy / 2 ;

    strcpy (lf.lfFaceName, "Times New Roman") ;

    hFont = CreateFontIndirect (&lf) ;

    SelectObject (hdc, hFont) ;
    SetTextAlign (hdc, TA_BOTTOM | TA_CENTER) ;
    SetBkMode    (hdc, TRANSPARENT) ;

    for (i = 1 ; i <= 5 ; i++)
    {
        ch = (char) (i + '0') ;

        TextOut (hdc, i * cx / 6, cy / 2, &ch, 1) ;
    }

    SelectObject (hdc, GetStockObject (SYSTEM_FONT)) ;

    DeleteObject (hFont) ;
}

void CreateRoutine (HWND hwnd)
{
    HDC      hdcEMF ;
    ENHMETAFILE hemf ;
    int      cxMms, cyMms, cxPix, cyPix, xDpi, yDpi ;

    hdcEMF = CreateEnhMetaFile (NULL, "emf9.emf", NULL,
                                "EMF9\\EMF Demo #9\\0") ;

    cxMms = GetDeviceCaps (hdcEMF, HORZSIZE) ;
    cyMms = GetDeviceCaps (hdcEMF, VERTSIZE) ;
    cxPix = GetDeviceCaps (hdcEMF, HORZRES) ;
    cyPix = GetDeviceCaps (hdcEMF, VERTRES) ;

    xDpi = cxPix * 254 / cxMms / 10 ;
    yDpi = cyPix * 254 / cyMms / 10 ;

    DrawRuler (hdcEMF, 6 * xDpi, yDpi) ;

    hemf = CloseEnhMetaFile (hdcEMF) ;

    DeleteEnhMetaFile (hemf) ;
}

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    ENHMETAHEADER emh ;
    ENHMETAFILE hemf ;
    int      cxImage, cyImage ;
    RECT      rect ;

    hemf = GetEnhMetaFile ("emf9.emf") ;

    GetEnhMetaFileHeader (hemf, sizeof (emh), &emh) ;

    cxImage = emh.rclBounds.right - emh.rclBounds.left ;
    cyImage = emh.rclBounds.bottom - emh.rclBounds.top ;

    rect.left   = (cxArea - cxImage) / 2 ;
    rect.right  = (cxArea + cxImage) / 2 ;
    rect.top    = (cyArea - cyImage) / 2 ;
    rect.bottom = (cyArea + cyImage) / 2 ;

    PlayEnhMetaFile (hdc, hemf, &rect) ;

    DeleteEnhMetaFile (hemf) ;
}

```



Figure 5: The EMF9.C file creates a metafile image of a ruler and displays it.

ally obtains information about the video display. I've been using Windows NT with a standard VGA, so GDI reports that the metafile device context has a size of 240 by 180 millimeters and 640 by 480 pixels.

Determining the resolution in dots per inch requires a fairly simple calculation: Divide the pixel dimension by the dimension in millimeters and multiply by 25.4, the number of millimeters in an inch. For the VGA, this calculation yields 67 dpi (dots per inch). At this point, EMF9 knows the pixel dimensions of the 6-inch ruler (402 by 67) and passes that information to the DrawRuler function, which does all the graphics drawing work.

Even though we've taken great care to draw this metafile ruler in its correct size, the work is not yet done. When the image is to be rendered, the PlayEnhMetaFile function will display it stretched to the rectangle passed as that function's last parameter. This rectangle must be set to the size of the ruler. For this reason, the

PaintRoutine function in EMF9 calls the GetEnhMetaFileHeader function to obtain the header information in the metafile. The rclBounds field of the ENHMETAHEADER structure indicates the bounding rectangle of the metafile image in pixels. In this case, the rectangle structure indicates that the upper-left corner of the image is at the point (0,0) and the bottom-right corner is at the point (402,67), as we expect. The



Figure 6: The EMF9 display shows a 6-inch ruler centered in the client area.

program uses this information to center the ruler in the client area, as shown in Figure 6. (Keep in mind that if you hold a ruler up to the screen, it probably won't match exactly unless you have the same VGA screen used by the anonymous Microsoft programmer who decided it was to be 240 by 180 pixels in size.)

This technique appears to have worked, but now try printing the image. Oops! If you have a 300 dpi laser printer, the ruler will be about 1 1/3 inches wide. That's because we used a pixel dimension based on the VGA. A 6-inch ruler may be 402 pixels long on the VGA, but it should be 1,800 pixels long on the laser printer. You may think the little printed ruler looks kind of cute, but it's not what we want. Let's try again.

THE MILLIMETER DIMENSION The ENHMETAHEADER structure contains two rectangle structures that describe the size of the image. The first, which EMF9 uses, is the rclBounds field.


```

/*-----
EMF10.C -- Enhanced Metafile Demo #10
(c) Charles Petzold, 1994
-----*/

#include <windows.h>
#include <string.h>

char szClass [] = "EMF10" ;
char szTitle [] = "EMF10: Enhanced Metafile Demo #10" ;

void CreateRoutine (HWND hwnd)
{
}

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    ENHMETAHEADER emh ;
    HENHMETAFILE hemf ;
    int cxMms, cyMms, cxPix, cyPix, cxImage, cyImage ;
    RECT rect ;

    cxMms = GetDeviceCaps (hdc, HORZSIZE) ;
    cyMms = GetDeviceCaps (hdc, VERTSIZE) ;
    cxPix = GetDeviceCaps (hdc, HORZRES) ;
    cyPix = GetDeviceCaps (hdc, VERTRES) ;

    hemf = GetEnhMetaFile ("emf9.emf") ;

    GetEnhMetaFileHeader (hemf, sizeof (emh), &emh) ;

    cxImage = emh.rclFrame.right - emh.rclFrame.left ;
    cyImage = emh.rclFrame.bottom - emh.rclFrame.top ;

    cxImage = cxImage * cxPix / cxMms / 100 ;
    cyImage = cyImage * cyPix / cyMms / 100 ;

    rect.left = (cxArea - cxImage) / 2 ;
    rect.right = (cxArea + cxImage) / 2 ;
    rect.top = (cyArea - cyImage) / 2 ;
    rect.bottom = (cyArea + cyImage) / 2 ;

    PlayEnhMetaFile (hdc, hemf, &rect) ;

    DeleteEnhMetaFile (hemf) ;
}

```



Figure 7: The EMF10.C file displays the ruler image based on its metrical dimensions.

This gives the size of the image in pixels. The second is the `rcIFrame` field, which gives the size of the image in units of 0.01 millimeters. The relationship between these two fields is governed by the reference device context originally used when

creating the metafile, which in this case is the VGA. The metafile header also contains two fields named `szlDevice` and `szlMillimeters`, which are `SIZEL` structures that indicate the size of the reference device in pixels and millimeters. This

is the same information available from `GetDeviceCaps`.

The information about the millimeter dimensions of the image is put to use by EMF10, shown in Figure 7. EMF10 uses the metafile created by EMF9, so be sure to run EMF9 before executing this program.

The `PaintRoutine` function in EMF10 begins by calling `GetDeviceCaps` four times using the destination device context. As in the `CreateRoutine` function in EMF9, these calls provide information about the resolution of the device. After getting the metafile handle, the function obtains the header structure and uses the `rcIFrame` field to calculate the size of the metafile image in units of 0.01 millimeters. That's the first step.

The function then converts this dimension to pixels by multiplying by the pixel dimension of the output device, dividing by the millimeter dimension, and then dividing by 100 to account for the metrical dimension in 0.01 millimeters. The `PaintRoutine` function now has the dimensions of the ruler in pixels but not necessarily VGA pixels. This is a pixel dimension appropriate for the destination device. From there on, it's easy to center the image.

On the screen, the EMF10 display looks the same as the EMF9 display. But if you print the ruler from EMF10, you'll see something that looks much more normal—a ruler 6 inches wide by 1 inch high. Actually measuring the printed ruler may be somewhat disconcerting, though. At least on my system, the printed ruler is

```

/*-----
EMF11.C -- Enhanced Metafile Demo #11
(c) Charles Petzold, 1994
-----*/

#include <windows.h>
#include <string.h>

char szClass [] = "EMF11" ;
char szTitle [] = "EMF11: Enhanced Metafile Demo #11" ;

void CreateRoutine (HWND hwnd)
{
}

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    ENHMETAHEADER emh ;
    float fScale ;
    HENHMETAFILE hemf ;
    int cxMms, cyMms, cxPix, cyPix, cxImage, cyImage ;
    RECT rect ;

    cxMms = GetDeviceCaps (hdc, HORZSIZE) ;
    cyMms = GetDeviceCaps (hdc, VERTSIZE) ;
    cxPix = GetDeviceCaps (hdc, HORZRES) ;
    cyPix = GetDeviceCaps (hdc, VERTRES) ;

```

```

    hemf = GetEnhMetaFile ("emf9.emf") ;

    GetEnhMetaFileHeader (hemf, sizeof (emh), &emh) ;

    cxImage = emh.rclFrame.right - emh.rclFrame.left ;
    cyImage = emh.rclFrame.bottom - emh.rclFrame.top ;

    cxImage = cxImage * cxPix / cxMms / 100 ;
    cyImage = cyImage * cyPix / cyMms / 100 ;

    fScale = min ((float) cxArea / cxImage, (float) cyArea / cyImage) ;

    cxImage = (int) (fScale * cxImage) ;
    cyImage = (int) (fScale * cyImage) ;

    rect.left = (cxArea - cxImage) / 2 ;
    rect.right = (cxArea + cxImage) / 2 ;
    rect.top = (cyArea - cyImage) / 2 ;
    rect.bottom = (cyArea + cyImage) / 2 ;

    PlayEnhMetaFile (hdc, hemf, &rect) ;

    DeleteEnhMetaFile (hemf) ;
}

```



Figure 8: The EMF11.C file displays the ruler image in its correct aspect ratio but not its correct size.

about 1/16 inch short of 6 inches. This is evidently due to rounding errors when calculating the resolution of the VGA in dots per inch. Since I'm not in the ruler business, I'm willing to live with this and pronounce EMF10 a success.

SCALING AND ASPECT RATIOS There may be times when you want use the ruler metafile created by EMF9, but without necessarily displaying the 6-inch image. Still, it might be nice to maintain the correct 6-to-1 aspect ratio of the image. As I mentioned before, using a bounding box to size a metafile in a word processing program (or whatever) may be convenient but could result in certain undesirable distortions. In such applications, users should have the option of keeping the original aspect ratio regardless of how the bounding box is sized. That is, the bounding box selected by the user would not be used directly to define the rectangle structure passed to the PlayEnhMetaFile. The rectangle structure passed to that function would be only part of the bounding box. Let's examine how to do this in the EMF11 program shown in Figure 8.

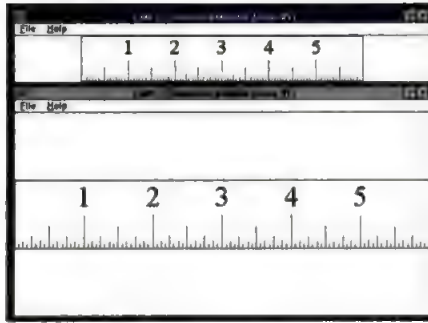


Figure 8: The EMF11 display shows how the ruler is scaled to the size of the client area.

EMF11 stretches the ruler image to fit the client area (or the printable area of the printer page) but without otherwise distorting it. Usually you'll see the ruler stretched the full width of the client area but centered between the top and bottom. If you make the window somewhat stout, the ruler will be as tall as the client area but centered horizontally. This is shown in Figure 9.

There are probably many ways to calculate the proper display rectangle, but I decided to build upon the code in EMF10.

The PaintRoutine function in EMF11.C begins as in EMF10.C, by calculating the pixel size of the 6-inch wide image appropriate for the destination device context. The program then calculates a floating-point value, fScale, that is the minimum of the ratio of the width of the client area to the width of the image and the ratio of the height of the client area to the height of the image. This factor is then used to increase the pixel dimensions of the image before the bounding rectangle is calculated.

WHY PIXELS? We've been drawing a ruler that displays inches, and we've also been dealing with dimensions in units of millimeters. Such tasks might seem like good candidates for using the various mapping modes provided under GDI. Yet I've insisted on using pixels and doing all the necessary calculations manually. Why is that?

The simple answer is that the use of mapping modes in connection with metafiles can be quite confusing. In the next installment, we'll explore these complexities and see if we can make some sense out of it all. □



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Power Programming

BY MATT PIETREK

Intercepting API Functions in Win32

For as long as programs have been able to call operating system functions, programmers have needed a way to redirect operating system calls to their own code. You might intercept an operating system API function to add additional processing to the original code or to replace the intercepted function entirely. If you're a Windows programmer who has used window subclassing, you know exactly what I'm talking about.

In DOS programming, intercepting calls to the operating system is usually accomplished by replacing an interrupt vector (such as the DOS INT 21h service vector) with the address of your own code. In fact, this is one of the basic techniques behind TSR (terminate and stay resident) programming. Intercepting operating system calls in this manner is relatively simple and doesn't require any real knowledge of the underlying operating system structures or executable files.

In the Microsoft Windows 3.x environment, intercepting calls to operating system functions located in DLLs like USER, KERNEL, and GDI is trickier than under DOS. Interrupts aren't used for calling Windows API functions, so programs that intercept API function calls typically end up modifying the code that's the target of the call. For example, they might change the first bytes of the memory image of an API routine such as LoadLibrary() to a CALL or JMP to their own code.

Patching code can lead to a variety of problems that are difficult to deal with, especially since Windows is a multitasking operating system with many programs using the same DLLs. In spite of these hurdles, programmers have successfully intercepted API function calls in Win-

dows 3.x. Prime examples are Adobe Type Manager and PROCHOOK.DLL presented by James Finnegan in the *Microsoft Systems Journal* of January 1994. There are other ways besides patching code to intercept functions in Windows 3.x (including the use of breakpoints), but they impose their own set of problems and aren't as commonly used.

Now that programmers are (slowly) moving to Win32 operating systems (Windows NT, Chicago, and Win32s), a new

way of intercepting API function calls is needed. Unlike DOS or Windows 3.x programs, each program under Windows NT or Chicago runs in a separate address space. Even if you successfully modify the beginning of a function's code, you probably don't have the code for your interception routine mapped into the address space of all the

processes that will call that routine. Access violation city! The technique I'll show here for intercepting Win32 API functions only affects one process at a time, unless you take other drastic measures. This differs from most API interception techniques in DOS and Windows 3.x programs, which intercept the API function calls made by all programs. But thanks to the structure of the new file format used by Win32 programs, intercepting calls to API functions is much simpler and cleaner than it was in Windows 3.x.

In this column, I'll present a technique

that lets you intercept all calls from a Win32 program to a function in another module; I'll also provide a program that demonstrates the use of this method. No patching is involved, and all you have to do is drop a single function into your Win32 program. This function relies on some interesting aspects of how implicit dynamic linking works in Win32 operating systems, which we'll explore. For a similar discussion of importing functions in Windows 3.x, see Jeff Prorise's Tutor column, "DLLs and Module References in Windows," in our issue of April 12, 1994.

IMPORTING FUNCTIONS IN WIN32 If you've ever stepped through a Windows 3.x program in an assembly-language debugger's window, you've probably seen instructions that call functions in the Windows system DLLs—for instance, a call to BeginPaint() in USER.EXE. If you trace into this call, you'll see that it goes directly to the BeginPaint() routine. In fact, all calls to Windows API functions transfer control directly to the code in the system DLL that implements the function.

Thanks to the structure of the new file format used by Win32 programs, intercepting calls to API functions is much simpler and cleaner than it was in Windows 3.x.

You might be wondering "How did the compiler magically know the correct address of the API function?" The fact is, it doesn't. When you compile your 16-bit Windows program, the compiler leaves 4 bytes after the CALL opcode where the imported function's address will be inserted. When you link the program, the linker adds a relocation record for this 4-byte

location into your .EXE or DLL. And when you run the program, the relocation record tells the Windows loader where it needs to fill in the address of the imported function. In the worst case, there can be one relocation record for each call to an imported API function. Though making each CALL instruction go directly to its target routine makes the code very fast, it imposes a lot of work on the Windows loader. Figure 1 shows a graphical representation of dynamic linking in Windows 3.x.

If you were to step through an equivalent call to BeginPaint() in a Win32 pro-

Win16 Dynamic Linking

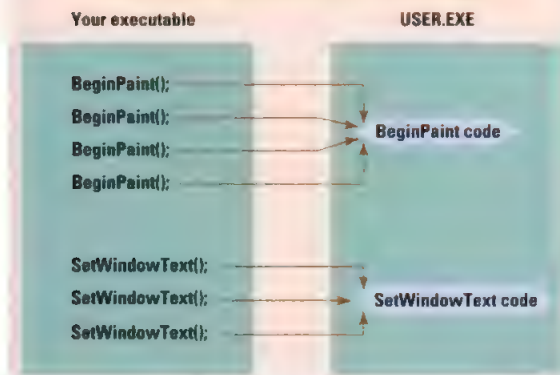


Figure 1: Each call a Windows 3.x program makes to a single imported function gets its own copy of the function's actual address.

gram, you'd be in for a bit of a surprise. After tracing into a call to a system API function in Win32, you'd find that the CALL instruction places you at an instruction in your code that looks like this:

```
JMP DWORD PTR [XXXXXXXX]
```

(where XXXXXXXX represents an address in your program). Tracing one more time (through the JMP instruction), you'd see that you're finally in the code of the imported function. It seems that there's a layer of indirection between the CALL instruction in your code and the actual target of the CALL. In fact, every call you make to BeginPaint() throughout your code winds up going through the same JMP instruction. Likewise, all your calls to some other API function, such as SetWindowText(), also go through a single JMP DWORD PTR [XXXXXXXX] instruction—albeit a different JMP instruction than that used by the BeginPaint() calls.

Figure 2 shows a representation of dynamic linking in Win32 programs. The extra JMP layer exists for a very good reason; it also provides us with a very clean way to intercept function calls. To see why this is so, we need to know something about the file format used by Win32 .EXEs and DLLs—the Portable Executable (PE) file format. For a complete description on Win32 files, refer to the several articles available on the Microsoft Developer's Network CD-ROM. In this column, we're only concerned with imported-function information.

Each PE file is composed of several sections. A Win32 file section is somewhat equivalent to a Win16 segment. But unlike segments, sections are not limited to a maximum size of 64K, nor does your code use separate selectors to access different sections. You can dump out and view the sections in a PE file with programs such as Microsoft's DUMPBIN, Borland's TDUMP, or PEDUMP from my article in the *Microsoft Systems Journal* of March 1994. Common sections found in a Win32 PE file include code and data

sections (.text, CODE, .data, DATA—the capital-letter versions are in Borland style), relocation information (.reloc), and resources (.rsrc). The section of interest to us is the imported-data section, .idata. The .idata section contains a list of all the DLLs that your program imports as well as the functions your program uses within those DLLs.

The layout of information in a PE file's .idata section is given by a few structures found in the WINNT.H file provided with your Win32 compiler. At the very beginning of an .idata section is an array of IMAGE_IMPORT_DESCRIPTOR structures. There is one IMAGE_IMPORT_DESCRIPTOR structure for each module the program implicitly links to (that is, for each DLL linked to via an import library). The end of this array of structures is indicated by a structure filled with 0s in all its fields. Almost any PE file will include at least one IMAGE_IMPORT_DESCRIPTOR structure in its .idata section, since almost every Win32 program links to KERNEL32.DLL. If your program makes use of graphics or windows, then it most likely also includes additional IMAGE_IMPORT_DESCRIPTORs for references to USER32.DLL and GDI32.DLL functions. You can run TDUMP or DUMPBIN on any

Win32 program and see this for yourself. If you don't have Chicago or Windows NT, you might try dumping out FREECELL.EXE, which comes with Win32s.

The fields of the IMAGE_IMPORT_DESCRIPTOR structure are shown in Figure 3. The first three fields aren't critically important to understanding how Win32 functions are imported (and ultimately intercepted), so I'll skip over them here. The Name field is a pointer to an ASCII string containing the filename of the DLL connected with this particular structure (for example, "KERNEL32.DLL"). To be perfectly accurate, the Name field isn't really a flat 32-bit pointer. Rather, you add the offset value in the Name field to the base memory address of the PE file containing the IMAGE_IMPORT_DESCRIPTOR to get a real 32-bit pointer. In Win32 files, fields holding values that need to be added to the PE module's base address are known as Relative Virtual Addresses, or RVAs.

The final field of an IMAGE_IMPORT_DESCRIPTOR holds the key to how Win32 functions are imported. Although the WINNT.H description of the FirstThunk field's significance can be very confusing, it's actually quite simple: The FirstThunk field is nothing more than a pointer (an RVA to be exact) to an array

Win32 Dynamic Linking

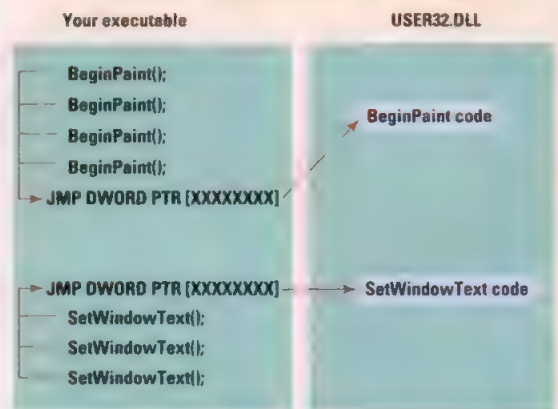


Figure 2: Each call a Win32 program makes to a single imported function goes through the same jump address.

of DWORDS found elsewhere in the .idata section. This array is known as the import address table. After a PE file has been loaded into memory by the Win32 loader, each DWORD in the import ad-

dress table contains the address of an imported function. Thus, one of the DWORDs might hold the address of the BeginPaint() function in USER32.DLL, while another DWORD could hold the address of SetWindowText(). For each imported DLL, the .idata section has a separate import address table, each holding the

```
typedef struct _IMAGE_IMPORT_DESCRIPTOR {
    DWORD Characteristics;
    DWORD TimeDateStamp;
    DWORD ForwarderChain;
    DWORD Name;
    PIMAGE_THUNK_DATA FirstThunk;
} IMAGE_IMPORT_DESCRIPTOR, *PIMAGE_IMPORT_DESCRIPTOR;
```

Figure 3: A Win32 PE file uses this structure to keep track of each module from which it imports functions.

addresses of the functions imported from that DLL. Figure 4 shows this graphically.

Here's where the pieces of the puzzle come together. Those JMP DWORD PTR [XXXXXXXX] stubs I mentioned earlier jump to the addresses stored in the DWORD arrays. Since all calls to a given imported function go through one of these JMP instructions, the Win32 loader only needs to insert the actual address of each imported function in one location—the appropriate DWORD in the array pointed to by FirstThunk. This is much more efficient than under 16-bit Windows, where the actual address of each imported function needs to be written out for each CALL to an imported function. In addition, because there's only one place in an entire PE module where an imported function's address is stored, it's very simple to intercept calls to imported functions. Replace that one DWORD with the address of your own routine, and you've intercepted all calls to that function. The code I'll present momentarily does just that.

One question that remains is how the Win32 loader knows which function addresses to put into the DWORD arrays in the .idata section. Before the PE file is loaded, the DWORD arrays in the file's .idata section contain relative offsets (RVAs) to strings holding the names of the imported functions. When the Win32 loader brings the file into memory, it takes each name pointer and calls GetProcAddress() with the function name the name pointer points to—for example,

```
GetProcAddress("BeginPaint")
```

The Win32 loader then overwrites the name pointer with the actual function address returned by the loader's GetProcAddress() call. Figure 5 shows the situation before and after the PE file is loaded.

When most people think of intercepting calls to a function, they usually focus on somehow gaining control when the destination of the CALL is reached (either by patching in JMP instructions or via breakpoints). Writing to the .idata section as we do here takes a different

approach. It intercepts calls at their source, before control ever gets to the destination. Because there's no code patching or breakpoint involved, this method is much cleaner.

Strange as it may seem, this interception method has more in common with DOS function interception than with most Windows 3.x interception techniques. In both the Win32 and DOS cases, you're simply replacing a pointer to an operating system function with a pointer to your own code. The key difference is that replacing a DOS interrupt vector is a global operation affecting all programs, while the Win32 interception technique only affects calls made by that PE module.

You may be asking, "But why would I want to intercept my own program's calls to the operating system? Why not just change my code to call the code that I really want to execute?" There are several good reasons. The first is that you might want to intercept calls made by a DLL that you didn't write and cannot modify. Second, with techniques such as systemwide message hooks, you can get a DLL you write loaded into an-

other process's address space. You can then modify the behavior of the other process.

INTERCEPTING FUNCTIONS IN YOUR OWN PROGRAMS The code to hook a Win32 API function is shown in the HOOKAPI.C listing in Figure 6. (You can download it as well as the other programs mentioned in this column from PC MagNet's Utilities/Tips Forum, archived as HOOKAP.ZIP.) The HookImportedFunction() function in HOOKAPI.C is the key to this technique. This function allows you to intercept all the calls that a PE module makes to a function imported from another module. For example, if you had a DLL called FOO.DLL, you could intercept all of FOO.DLL's calls to the MessageBox() API function routine. If you also wanted to intercept MessageBox() calls made by BAR.DLL and BAZ.DLL, you'd need to call the HookImportedFunction() routine once for each of those DLLs as well.

An important point to remember when using HookImportedFunction() is that this interception method only intercepts calls to imported functions made

How Win32 Keeps Track of Imported Functions

Your executable's .idata section

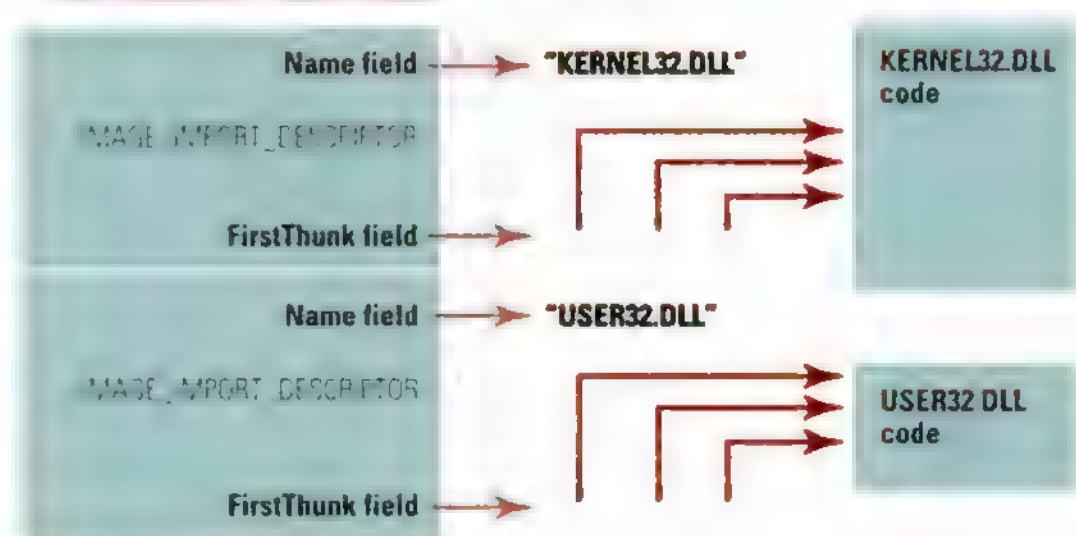


Figure 4: Each DLL from which a Win32 program imports any functions gets an IMAGE_IMPORT_DESCRIPTOR structure in the program's .idata section. The FirstThunk field of this structure points to an array (the import address table) holding the addresses of the imported functions.

within your own process. It can't intercept calls made to API functions by other processes. In other words, you can only intercept calls that your .EXE and its DLLs make. You couldn't use HookImportedFunction() to do something like intercepting all calls that WINFILE (or some other arbitrary program) makes to

OpenFile. This is because your interception routine won't be mapped into the address space of the WINFILE process.

The first parameter to HookImportedFunction() is the module handle of the PE module that you want to intercept calls from (in the above example, FOO.DLL). The second parameter is a string pointer to the name of the PE module containing the function you want to intercept. The third argument to HookImportedFunction() is a string pointer to the name of the function you want to intercept. The final parameter is the address of the function that you want to act as your interception routine. HookImportedFunction() returns the original address of the function you just intercepted. You can use this address to chain on to the original code if necessary. A typical call to HookImportedFunction() looks like this:

```
pfnOriginalProc = HookImportedFunction(
(
    GetModuleHandle("BAR.DLL"),
    "USER32.DLL",
    "MessageBoxA",
    MyMessageBoxHandler
));
```

Your interception function that is called instead of the original API function should be prototyped exactly the same as the function you're intercepting. This allows you to access all the function's parameters, and causes the compiler to pop the correct number of bytes off the stack when your function returns. If you want to pass control to the original API function as part of your handling, call through the function pointer returned by HookImportedFunction(). Typically, this will be the last thing your handler function does, only followed by returning whatever value the original API function returns to your code.

Let's look at HookImportedFunction() to see how it works. As I described earlier, when a Win32 program calls a function imported from another module, the call actually transfers control to a JMP DWORD PTR [XXXXXXXX] thunk. The DWORD at memory location XXXXXXXX in the .idata section contains the address of the imported function (for example, the address of MessageBox() in USER32.DLL). In a

nutshell, all that HookImportedFunction() does is search through the .idata section of the PE module to find the particular DWORD with the address of the function you want to intercept. Once it finds that location, HookImportedFunction() overwrites the address of the imported function with the address of your handler function. Of course, HookImportedFunction() also needs to return the address originally stored in that DWORD in order for you to chain on to the original code.

In Windows NT and Chicago, a module handle (that is, an HMODULE) is nothing more than the linear address where the module begins in memory. This address is known as the module's *base address*. Since Win32 uses memory-mapped files, the first 2 bytes in memory at the module's base address are a DOS "MZ" header (refer to the IMAGE_DOS_HEADER in WINNT.H). Using the value in the IMAGE_DOS_HEADER.e_lfanew field in the MZ header, HookImportedFunction() finds the address of the Portable Executable header. The format of a PE header is defined in WINNT.H as the IMAGE_NT_HEADERS structure. At the end of the IMAGE_NT_HEADERS structure is an array of structures containing offsets to important areas in the PE module. The offset that the HookImportedFunction() routine is interested in is the start of the module's imported data (.idata) section.

As I mentioned earlier, at the beginning of the .idata section is an array of IMAGE_IMPORT_DESCRIPTOR structures (again, see WINNT.H). HookImportedFunction() iterates through the

The Import Address Table Before And After Loading

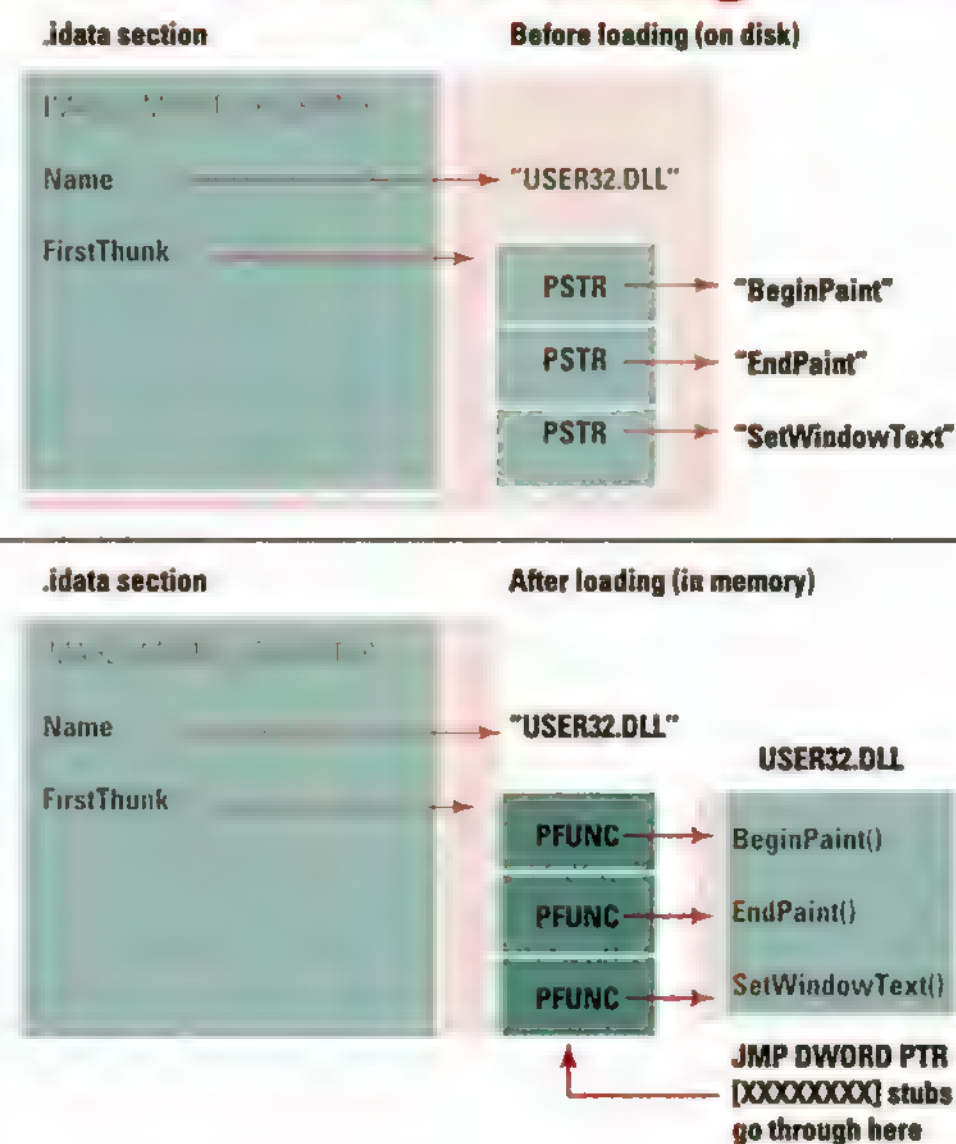


Figure 5: Before a Win32 program is loaded, its import address table's DWORDs contain pointers to strings holding the names of the imported functions. After the program is loaded, the DWORDs contain the actual addresses of the functions.

IMAGE_IMPORT_DESCRIPTOR structures until it finds the structure whose name matches the second parameter passed to HookImportedFunction()—the module containing the function we're seeking. Once the correct IMAGE_IMPORT_DESCRIPTOR structure has been found, HookImportedFunction() creates a pointer to that structure's import address table.

Near the start of its code, HookImportedFunction() called GetProcAddress() to get the address of the function we want to intercept calls to. That particular address should also exist in the import address table we just located. The HookImportedFunction() code iterates through the DWORD array of addresses until it finds the DWORD slot holding an address identical to that returned by the earlier call to GetProcAddress(). All that remains is to copy the interception function's address (the fourth parameter, pfnNewProc) into that slot, and return the DWORD ad-


```
//=====
// HOOKAPI - Matt Pietrek 1994
// FILE: HOOKAPI.C
//=====
#include <windows.h>
#include <string.h>
#include "hookapi.h"

// Macro for adding pointers/DWORDs without C arithmetic interfering
#define MakePtr(cast,ptr,addValue) (cast)((DWORD)(ptr)+(DWORD)(addValue))
DWORD GetModuleBaseFromWin32sHMod(HMODULE hMod); // Prototype

PROC WINAPI HookImportedFunction(
    HMODULE hFromModule, // Module to intercept calls from
    PSTR pszFunctionModule, // Module to intercept calls to
    PSTR pszFunctionName, // Function to intercept calls to
    PROC pfnNewProc) // New function (replaces original)
{
    PROC pfnOriginalProc;
    PIMAGE_DOS_HEADER pDosHeader;
    PIMAGE_NT_HEADERS pNtHeader;
    PIMAGE_IMPORT_DESCRIPTOR pImportDesc;
    PIMAGE_THUNK_DATA pThunk;

    if ( !IsBadCodePtr((PVOID)pfnNewProc) ) // Verify that a valid pfn was
        // passed
        return 0;

    // Verify the the module and function names passed to us are valid
    pfnOriginalProc = GetProcAddress(GetModuleHandle(pszFunctionModule),
        pszFunctionName );

    if ( !pfnOriginalProc )
        return 0;

    if ( (GetVersion() & 0xC0000000) == 0x80000000 ) // Win32s
        pDosHeader =
(PIMAGE_DOS_HEADER)GetModuleBaseFromWin32sHMod(hFromModule);
    else
        pDosHeader = (PIMAGE_DOS_HEADER)hFromModule; // other

    // Tests to ensure we have a module image (the 'MZ' header)
    if ( !IsBadReadPtr(pDosHeader, sizeof(IMAGE_DOS_HEADER)) )
        return 0;
    if ( pDosHeader->e_magic != IMAGE_DOS_SIGNATURE )
        return 0;

    // The MZ header has a pointer to the PE header
    pNtHeader = MakePtr(PIMAGE_NT_HEADERS, pDosHeader,
        pDosHeader->e_lfanew);

    // More tests to make sure we're looking at a "PE" image
    if ( !IsBadReadPtr(pNtHeader, sizeof(IMAGE_NT_HEADERS)) )
        return 0;
    if ( pNtHeader->Signature != IMAGE_NT_SIGNATURE )
        return 0;

    // We know have a valid pointer to the module's PE header. Now
    // go get a pointer to its imports section (.idata)
    pImportDesc = MakePtr(PIMAGE_IMPORT_DESCRIPTOR, pDosHeader,
        pNtHeader->OptionalHeader.
        DataDirectory[IMAGE_DIRECTORY_ENTRY_IMPORT].
        VirtualAddress);

    // Bail out if the RVA of the imports section is 0 (doesn't exist)
    if ( pImportDesc == (PIMAGE_IMPORT_DESCRIPTOR)pNtHeader )
        return FALSE;

    // Iterate through the array of imported module descriptors.
    //looking for the module whose name matches the
    //pszFunctionModule parameter
```

```
while ( pImportDesc->Name )
{
    PSTR pszModName = MakePtr(PSTR, pDosHeader, pImportDesc->Name);

    if ( strcmp(pszModName, pszFunctionModule) == 0 )
        break;

    pImportDesc++; // Advance to next imported module descriptor
}

// Bail out if we didn't find the import module descriptor for the
// specified module. pImportDesc->Name will be non-zero if found.
if ( pImportDesc->Name == 0 )
    return 0;

// Get a pointer to the found module's import address table (IAT)
pThunk = MakePtr(PIMAGE_THUNK_DATA, pDosHeader,
    pImportDesc->FirstThunk);

// Blast through the table of import addresses, looking for the one
// that matches the address we got back from GetProcAddress above.
while ( pThunk->ul.Function )
{
    if ( pThunk->ul.Function == (PDWORD)pfnOriginalProc )
    {
        // We found it! Overwrite the original address with the
        // address of the interception function.
        // Return the original address to the
        // caller so that they can chain on to it.
        pThunk->ul.Function = (PDWORD)pfnNewProc;
        return pfnOriginalProc;
    }

    pThunk++; // Advance to next imported function address
}

return 0; // Function not found
}

typedef DWORD (__stdcall *XPROC)(DWORD);

// Converts an HMODULE under Win32s to a base address in memory
DWORD GetModuleBaseFromWin32sHMod(HMODULE hMod)
{
    XPROC ImteFromHModule, BaseAddrFromImte;
    HMODULE hModule;
    DWORD imte;

    hModule = GetModuleHandle("W32SKRNL.DLL");
    if( !hModule )
        return 0;

    ImteFromHModule=(XPROC)GetProcAddress(hModule, "_ImteFromHModule@4");
    if ( !ImteFromHModule )
        return 0;

    BaseAddrFromImte=(XPROC)GetProcAddress(hModule, "_BaseAddrFromImte@4");
    if ( !BaseAddrFromImte )
        return 0;

    imte = ImteFromHModule( (DWORD)hMod);
    if ( !imte )
        return 0;

    return BaseAddrFromImte(imte);
}
```



Figure 6: This function will intercept the calls a PE program makes to a function located in another module and redirect them to code you specify.

dress originally in that slot.

There's one eccentricity in the HookImportedFunction() code. Under Win32s, an HMODULE is unfortunately not the base address where the module is loaded in memory. When HookImportedFunction() sees that it's running under Win32s, it calls a routine I wrote—GetModuleBaseFromWin32sHMod()—to convert the Win32s HMODULE to a usable base address. This function uses two undocumented functions in addition

to LoadLibrary and GetProcAddress. Because the function uses LoadLibrary and GetProcAddress instead of calling the undocumented Win32s functions directly, you can drop it into a program running under Windows NT and it won't give unresolved fixup error messages. Therefore, you can include the entire HOOKAPI.C code in your program and not worry about whether the program will run under Windows NT, Chicago, or Win32s.

To demonstrate the use of HookImportedFunction(), I've written the SIMONSEZ program. SIMONSEZ is extremely simple. Its goal is to intercept calls to MessageBox() and preface whatever text will be displayed with the string "Simon Sez: ". To run it, you'll need Windows NT, Chicago, or the Win32s libraries installed on top of Windows 3.1 or later.

The SIMONSEZ.C program is listed in Figure 7. The SIMONSEZ code first


```
#include <windows.h>
#include <malloc.h>
#include "hookapi.h"

// Make a typedef for the WINAPI function we're going to intercept
typedef int (__stdcall *MESSAGEBOXPROC)(HWND, LPCSTR, LPCSTR, UINT);

MESSAGEBOXPROC PfnOriginalMessageBox; // for storing original address

//
// A special version of MessageBox that always prepends "Simon Sez: "
// to the text that will be displayed.
//
int WINAPI MyMessageBox( HWND hWnd, LPCSTR lpText,
                        LPCSTR lpCaption, UINT uType )
{
    int retValue; // real MessageBox return value
    PSTR lpzRevisedString; // pointer to our modified string

    // Allocate space for our revised string, add 40 bytes for new
    // stuff
    lpzRevisedString = malloc( strlen(lpText) + 40 );

    // Now modify the original string to first say "Simon Sez: "
    if ( lpzRevisedString )
    {
        strcpy(lpzRevisedString, "Simon Sez: ");
        strcat(lpzRevisedString, lpText);
    }
    else // If malloc() failed, just
        lpzRevisedString = (PSTR)lpText; // use the original string.

    // Chain on to the original function in USER32.DLL.
    retValue = PfnOriginalMessageBox(hWnd, lpzRevisedString,
                                     lpCaption, uType);

    if ( lpzRevisedString != lpText ) // If we successfully allocated

        free( lpzRevisedString ); // string memory, free it.

    return retValue; // Return whatever the real MessageBox returned
}

int APIENTRY WinMain( HANDLE hInstance, HANDLE hPrevInstance,
                     LPSTR lpzCmdLine, int nCmdShow )
{
    MessageBox(0, "MessageBox Isn't Intercepted Yet", "Test", MB_OK);

    // Intercept the calls that this module (TESTHOOK) makes to
    // MessageBox() in USER32.DLL. The function that intercepts the
    // calls will be MyMessageBox(), above.

    PfnOriginalMessageBox = (MESSAGEBOXPROC) HookImportedFunction(
        GetModuleHandle(0), // Hook our own module
        "USER32.DLL", // MessageBox is in USER32
        "MessageBoxA", // function to intercept
        (PROC)MyMessageBox); // interception function

    if ( !PfnOriginalMessageBox ) // Make sure the interception
        worked
    {
        MessageBox(0, "Couldn't hook function", 0, MB_OK);
        return 0;
    }

    // Call MessageBox again. However, since we've now intercepted
    // MessageBox, control should first go to our own function
    // (MyMessageBox), rather than the MessageBox() code in USER32.DLL.

    MessageBox(0, "MessageBox Is Now Intercepted", "Test", MB_OK);
    return 0;
}
```



Figure 7: This program demonstrates an interception of a Win32 API function.

calls `MessageBox()` before `MessageBox()` has been intercepted to prove that there's nothing funny up its sleeve. Next, `SIMONSEZ` intercepts the `MessageBox()` API function and redirects calls to the `MyMessageBox()` function (which is also part of the `SIMONSEZ.C` code). `SIMONSEZ` then calls `MessageBox()` again, this time to show that we've successfully intercepted `MessageBox()` calls.

The `MyMessageBox()` code, which replaces the `MessageBox()` function, makes a copy of the original string passed to `MessageBox()` and prefaces it with the string "Simon Sez: ". Before exiting, the routine chains control on to the original API function (in this case, the real `MessageBox()` code), which will actually build the message box. It does this by calling through the function pointer obtained when we intercepted `MessageBox()`.

Chaining onto the original function is optional. If you don't want the original imported function to be called at all, don't call it in your interception routine. Also, be sure you don't directly call the function that you've intercepted in your interception routine: This could lead to an infinite recursion. That's why `MyMessageBox()` calls the real `Mes-`

`sageBox()` code through a function pointer, rather than calling `MessageBox()` directly.

While the `SIMONSEZ` example is somewhat contrived, there are many possible good uses for Win32 API function interception. For example, checking functions that should be called in pairs, such as `HeapAlloc` and `HeapFree`. You might intercept both functions and increment a variable whenever `HeapAlloc` is called and decrement it when `HeapFree` is called. At the end of the program, if the variable isn't 0, you've either forgotten to free something, or you've freed something twice. The important thing to remember is that you're only intercepting functions within your process. Intercepting calls to an API function from any process in Windows NT or Chicago is extremely tricky, as each process has its own address space. Your only hope here is to put your interception code into a DLL and force the operating system to load that DLL into the context of each process. In Windows NT, there's a registry entry that allows you to do this:

```
HKEY_LOCAL_MACHINE\Software\Microsoft
\Windows NT\CurrentVersion
\Windows\APPINIT_DLLS
```

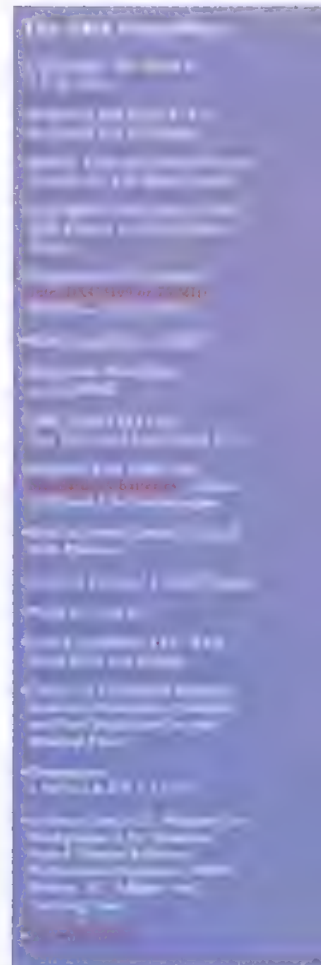
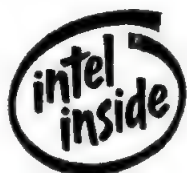
Whenever Windows NT starts a process, it looks at this registry entry, and if any DLLs are listed, effectively does a `LoadLibrary` on that DLL. Although this functionality is intended for supporting systemwide message hooks, it can be used for other purposes—including API interception. At the time of this writing, it's unclear whether this same functionality will be available in Chicago.

Because Chicago and Windows NT have a separate address space for each process, the traditional method of intercepting API function calls is no longer an option. But this doesn't mean that API interception cannot be accomplished. Although the code presented here is limited to operating within its own process, I hope this discussion has given you some insights as to how you might tackle similar problems. I think you'll find the technique presented here much cleaner and easier to use than the messy in-memory code modifications used in Windows 3.x. □

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Special Report: Shareware

BY NEIL J. RUBENKING

The DOOM Phenomenon

Repent, for DOOM is at hand! This 3-D first-person shoot-em-up game from id Software is news wherever you go. The Internet's alt.games.doom area has over 10,000 messages, and a recent DOOM conference on ZiffNet's Computer Gaming World Forum was so popular it forced an expansion of the message base. There are three books devoted to DOOM. A 90-page FAQ (frequently asked questions) file about DOOM explains, among other things, where to get hundreds of other DOOM-related files. (Download it as DOOMFQ.ZIP from Library 8 of CompuServe's Gamers Forum or send Internet e-mail to ap641@cleveland.freenet.edu with the subject "DOOM FAQ Request.")

DOOM consists of three nine-level episodes, the first of which is available for free evaluation, shareware style. Because it's such a hefty download, some choose simply to buy the first episode on-disk for \$5. id doesn't require registration for continued use of the first episode. They assume you'll find it so addictive you'll happily pay the \$40 registration for the other two levels. And they're right: DOOM is the best selling shareware game ever.

What makes DOOM so special? Simplicity, realism, and profound carnage (Figure 1). A few simple commands using the keyboard, mouse, or joystick let you move through DOOM's world, fire a weapon, and activate doors and switches. The uncluttered screen shows the view from your character's eyes, including the ever-protruding weapon of your choice. Your presence in DOOM's hellish realm is continuous; there's no wait while the computer draws the next room. You can

turn, move, slide along walls, and duck in your chair when a fireball comes at you. Some players complain of motion sickness, it's so realistic!

DOOM's immediate ancestor is Wolfenstein 3D, a popular shareware game in its time. However, where Wolfenstein had flat floors and fixed-height ceilings, DOOM requires neither. In fact, the ceiling may come down and crush you! Where Wolfenstein's walls were all at right angles, DOOM's texture-mapped walls can meet at any angle. It's harder to keep your bearings in DOOM, but the built-in AutoMap displays the portion of the level that you've seen. On top of this, DOOM adds variable lighting that diminishes in the distance or flickers. It even has rooms where the only light comes from weapon fire. Stereo sound further heightens the experience. DOOM monsters are smart, too. If they hear gunfire, they'll come running. But woe to the monster who accidentally shoots a fellow fiend; the two will ignore you and shred each other.

The registered version of DOOM features ten types of monsters and eight types of weapons, from bare fists to the irresistible BFG 9000. Your goal is to complete each level in turn and face down the "boss monster" in the final level. To complete a level, you splatter as many monsters as necessary to reach the exit. At the end of each level, you're rated on speed and the percentages of monsters killed, secrets found, and items acquired. Many DOOM players feel they haven't completed a level unless they achieve a 100 percent rating in all

categories. There are also five difficulty levels, from I'm Too Young to Die to Nightmare, in which dead monsters don't stay dead and cheat codes (see Figure 2) don't work. And if the computerized forces of hell aren't challenging enough, play against human opponents via network or modem.

MULTIPLAYER DOOM Two to four players can share a game of DOOM over a network. A cooperative mode is available, but Deathmatch mode, in which scoring is based on fragging (killing) the other players, is vastly more popular. Some companies, Intel among them, have banned this mode of DOOM. Other offices turn into sinister DOOM parlors after working hours, with shouts of "Got you!" and "Argh!" among the milder exclamations from the cubicles. Needless to say, the cheat codes are disabled in Deathmatch.

DOOM's initial release could bring a network to its knees because of its use of high-level broadcast packets. The current version, 1.2, uses simple low-level IPX services, so it should work with virtually any type of network with no ill effects. Still, you should check with your network administrator before loading DOOM.



Figure 1: Only a true DOOM maniac would attack two Barons of Hell with nothing but a chainsaw.

Note that multiplayer DOOM requires a registered copy for each player. At-home players and others not blessed with a network can play head to head over a serial connection. Many BBSs carry lists of modem DOOM players sorted by area code. A noisy line can interfere, however, and a minimum of 9,600 baud is required.

OPEN ARCHITECTURE DOOM's levels are stored in a huge file with the extension .WAD. id has made the .WAD file format public, and DOOM includes a

■ The PC Magazine/Ziff-Davis Interactive Shareware Awards

In this issue we honor DOOM, the overall winner of the first PC Magazine/Ziff-Davis Interactive Shareware Awards. The awards were created this year to recognize the best shareware our industry has to offer. Hundreds of nominations were submitted to the sponsoring magazines (*Computer Gaming World*, *MacUser*, and *PC Magazine*)

for review. Each magazine judged the shareware based on originality, creativity, and usefulness. Out of these nominees, only a handful were selected as finalists in several categories relating to each publication's editorial mission.

The award winners represent the best new or significantly upgraded shareware from January 1, 1993, through June 1,

1994. Here are all of the finalists followed by the author or publisher name and the ZiffNet filename. All of the finalists will be available on ZiffNet in the Public Brand Software Applications Forum, Library 14 (GO PBSAPP). You will also be able to browse through the finalists and download the programs by typing GO ZDAWARDS.

Finalists

Title	Download filename
Business and Finance	
**Checkmate Plus (CTech, Inc.)	CHKMT.ZIP
**Money Smith (Money Smith Systems, Inc.)	MSMITH.ZIP
*Painless Accounting for Windows (Painless Accounting, Inc.)	PNACW.ZIP
WPRO93 (F. Roland Bjorklund)	WPRO93.ZIP
Education	
Animated Clock (Tom Guthery)	ACLOCK.ZIP
Animated Multiplication & Division (Tom Guthery)	AMD.ZIP
Gradebook for Windows (R & R EdWare)	GB4WIN.ZIP
*Hide n' Seek (Phillip L. Lynch)	HDSK.ZIP
**WinFlash (Open Windows)	WFLASH.ZIP
Games	
*DOOM (id Software)	DOOM.ZIP
Epic Pinball (Epic MegaGames)	SPIN.ZIP
MVP Bridge (MVP Software)	MVPBR.ZIP
**Raptor (Apogee Software)	RAPTOR.ZIP
Ultimate Gin (Terry C. Hastings)	ULTGIN.ZIP
Graphics	
Envision Publisher (Software Vision)	ENVIS.ZIP
Graphic Workshop for Windows (Alchemy Mindworks, Inc.)	GWSWIN.ZIP
**ImageCommander (JASC, Inc.)	IC.ZIP
*Paint Shop Pro (JASC, Inc.)	PSPRO.ZIP
Top Draw (Top Software)	TOPDRW.ZIP
Home and Hobby	
Cross-Stitch Designer (HobbyWare)	CSD.ZIP
**GeoClock (Joe Ahlgren)	GEOCLK.ZIP
Grocery Manager for Windows (Absolute Value Software)	GMW.ZIP
**Movies to Go! (ImagiSOFT, Inc.)	MOVIE.ZIP
Video Librarian (TurboSystemsCo)	VIDLIB.ZIP

Title	Download filename
Multimedia and Presentation	
Demo Workshop (P2 Enterprises)	DWRK.ZIP
*NeoBook Professional (NeoSoft)	NBOOKP.ZIP
NeoShow Professional (NeoSoft)	NSPRO.ZIP
**QuickShow Lite for Windows (Alchemy Mindworks, Inc.)	QSHOW.ZIP
StoryMaker+ (Elson Embry)	STORY.ZIP
PIMs and Calendars	
Address Manager (Wilson WindowWare, Inc.)	ADDMAN.ZIP
A Project/Event Planner (Sapphire Software Inc.)	APLANR.ZIP
Smart Address (Oakley Data Services)	SMTADR.ZIP
*Time & Chaos (Isbister International)	TCHAOS.ZIP
**Visual Calendar Planner (Bok Nan Lo)	3DVCP.ZIP
Utilities (DOS)	
Directory Maven (Kent Briggs)	DMAV.ZIP
*4DOS (JP Software, Inc.)	4DOS.ZIP
**GoHome Scheduler/Automator (Added Dimension Software, Inc.)	GOHOME.ZIP
Integrity Master (Stiller Research)	INTMST.ZIP
QuikMenu (NeoSoft)	QKMENU.ZIP
Utilities (Windows)	
*Drag and File (Canyon Software)	DRAGFL.ZIP
**Plug-In for Windows (Plannet Crafters, Inc.)	PLUGIN.ZIP
winformant (Joseph Albanese)	WN4MNT.ZIP
WinUpD8R (Open Windows)	WINUPD.ZIP
WizManager (Mijenix Corp.)	WIZMGR.ZIP
WOPR Add-ins for Word for Windows 6.0 (Pinecliffe International)	WOPR.ZIP

* Winner ** Runner-up

method for loading third-party levels. id's only restriction is that such levels may not be exploited commercially. There are dozens of utilities dedicated to creating or changing DOOM levels. You can change the sound effects, the music, the level layout, or even create entirely new levels. This open architecture has turned DOOM from a mere game to an

addictive hobby for many.

Utilities such as DMAUD make it easy to replace any of the 61 sound effects in DOOM. You'll find movie audio collections that make DOOM sound like Aliens, Star Trek, or Star Wars. On the silly side, there are sounds from Monty Python, The Simpsons, and The Three Stooges along with some truly demented

collections. (Imagine a pink demon warbling, "Honey! I'm home!" when it spots you.)

Too familiar with the standard levels? Randomize them with RANDOOM, which redistributes the objects and monsters. Or modify the level itself with a level editor like DEU (DOS) or DoomCAD (Windows). Creating a whole level

Cheat code	Effect
iddqd	Degreelessness mode (God Mode)—complete invulnerability until you toggle this mode off.
idkfa	Very Happy Ammo mode—gives all weapons, full ammo of all types, 200 percent armor, and all keys.
idspispopd	No-clipping mode—walk through walls. To flip a switch or open a door you must turn this mode off.
idchoppers	Get the chainsaw (and a cryptic message).
idmt	If AutoMap is showing, cycles between normal map, full map, and full map with objects and enemies.
idbeholds	Get berserk strength.
idbeholdv	Get temporary invulnerability.
idbeholdi	Get temporary partial invisibility.
idbeholda	Get full AutoMap.
idbeholdr	Get antiradiation suit.
idbeholdl	Get light-amplification visor.
idcleve	Followed by episode and level number, warps directly to that level.
idmpos	Display coordinates and heading.

Figure 2: These cheat codes let you play tourist and experience DOOM regardless of your skill level. To invoke a code, simply type it at the keyboard while in the game.

from scratch is tough, however, as we'll see below.

The most demanding modification is adding new animation—for example, replacing one of the monsters. The DOOM engine handles lighting, sizing the image, and so on. For each animation frame, however, you must provide a view from eight different directions. Typically this amounts to 60 or more images. This difficulty hasn't prevented DOOM enthusiasts from replacing the pink demons with Barney the purple dinosaur.

DOOM DEVELOPMENT id's developers build DOOM levels using DoomEd, a proprietary editor that runs only on the NeXT computer. Using DoomEd, they can easily create the level's layout and place monsters and objects as needed. Bitmapped images of visible elements are drawn from a common pool. Objects in DOOM have attributes such as weight and momentum. So, for example, when you blow up a toxic waste barrel nearby monsters are tossed realistically by the blast. Inanimate objects such as ammo boxes are displayed from a single viewpoint (they always seem to face you). Animation for monsters is digitized from detailed physical models.

A DOOM level is basically a simple two-dimensional map. The map is divided into closed polygons called *sectors*, the lines forming the sectors are *linedefs*, and the points where two or more linedefs meet are *vertices*. Echoes of high-school geometry! Sectors have properties such as

height and texture for floor and ceiling in addition to a variety of specialized properties. For example, some sectors cause damage to a player standing in them: Lower the floor a bit and give it a sickly green texture, and you've got a pool of toxic waste!

The wall panels in a DOOM level are textures applied to linedefs. Linedefs can be set to trigger actions when the player pushes them using the Spacebar or walks over them. For example, a door is actually a sector whose ceiling is normally at floor height. Pushing the wall on either side causes the ceiling to rise, opening the door.

The hardest thing DOOM has to do is instantly translate the player's ever-changing position and direction into a rendered 3-D view. To speed the rendering process, DOOM uses a precomputed binary space partition (BSP) of the level (Figure 3). The level editor divides the map into two regions, then divides each region in two, continuing to divide until every region contains only walls that can't possibly hide each other from the player's view. This simplifies determining just what walls are visible. It also means, however, that sectors and linedefs are immovable. Look closely and you'll see that all motion of the walls and floors in DOOM is strictly up and down.

ANATOMY OF A DOOM LEVEL So just what does it take to build a level? Let's build a very simple one using DoomCAD. We'll create two rooms separated by a door. To complete the level, you'll open the door and press a switch in the other room. Sounds simple? Just wait!

A new level in DoomCAD starts out as one huge rectangular sector. To start, resize this sector into a smaller room. Select Vertexes from the Mode menu and just drag each vertex toward the center of the level to create a box roughly 512 units on a side. Zoom in a few times to make the room easier to work with. Now switch to Things mode and look for a gray dot representing the player's starting position; drag it into the room.

Add four vertices to the right of the initial room, forming a rectangle about the same size. In Sectors mode, select Add Sector and click on the vertices of the new sector one at a time, going clockwise until the rectangle is complete. Right-click to finish the sector. You now have two adjacent rectangles with a little space between them.

In LineDef mode, select the right side of the left room. Select Split from the LineDef menu; this splits the line by inserting a new vertex in the middle. Select

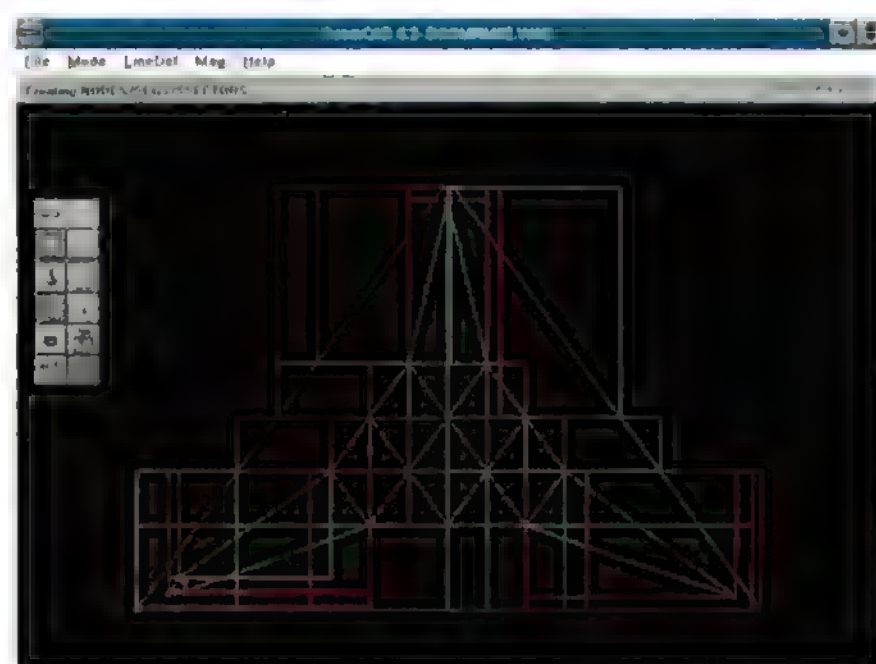
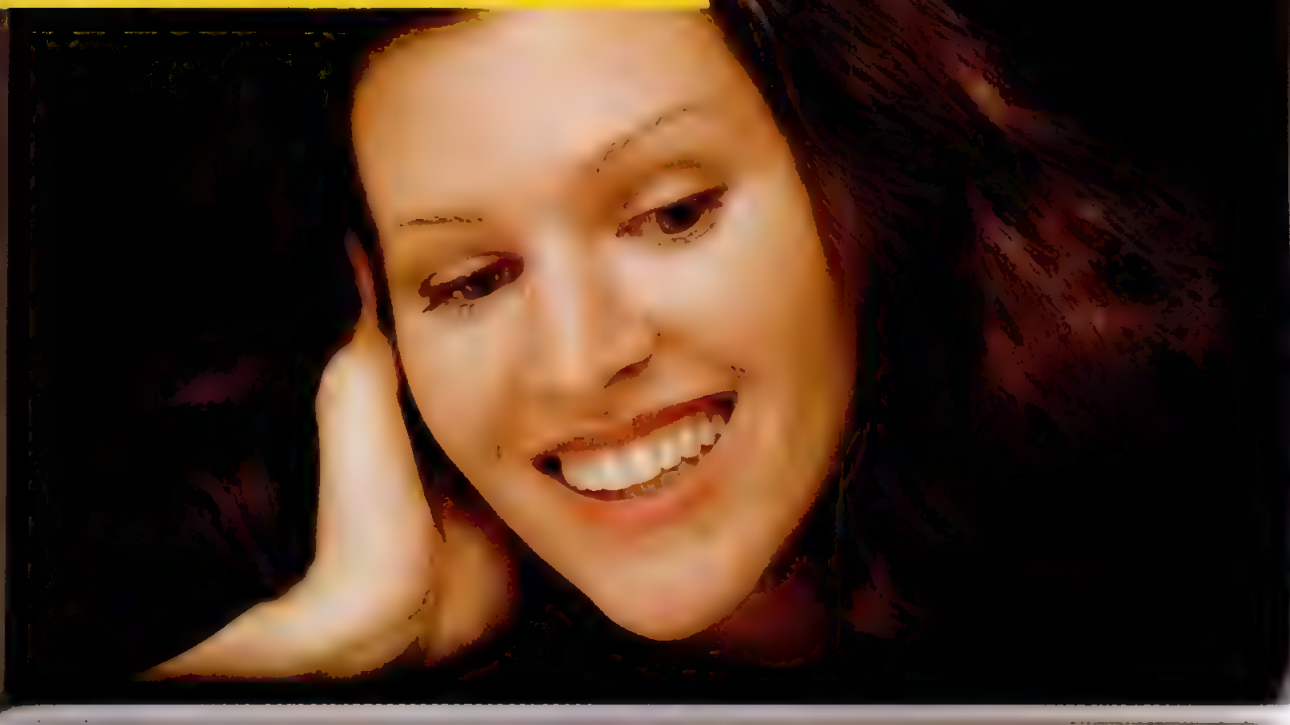


Figure 3: Here DoomCAD has almost finished the binary space partition of a simple level with triangular sectors. The pale-blue lines are the walls of the sectors; the red and white lines show the BSP divisions.

the upper of the two new lines and split it again. Do the same to the left side of the right room. Adjust the position of the four new vertices so that they form a rectangle 128 units high and 16 units wide; this rectangle will become the door. In Sectors mode, add a new sector with these ver-

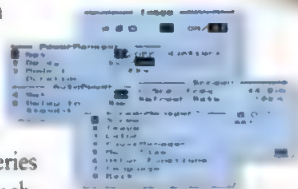
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■ Is the Future DOOMed?

By Neil J. Rubenking

DOS is dead, we hear, and DOOM is strictly DOS based. Microsoft is, however, working on a new library of game-related functions for Windows (and Chicago) called WinG. A Windows version of DOOM is WinG's proof of concept and an unofficial touchstone for Chicago.

But that's not the biggest news. On October 10, 1994, id will release a commercial sequel titled DOOM II: Hell On Earth. The story picks up where DOOM left off. Our hero has vanquished demonic forces and returns to Earth, only to find that the enemy got there first. Rabid DOOM players will relish blowing away the five new monsters with the new Super Shotgun (Figure A). DOOM II will use roughly the same engine and .WAD file format as the existing DOOM, so there won't be major changes in the style of play. Third-party DOOM editors will work

after a minimum of modification. The real quantum leap will come with id's totally redesigned gaming engine, code-named Quake and expected in early 1995. id's CEO was unwilling to reveal details about the Quake engine's features, perhaps for fear of riots by rabid DOOM fans.



Figure A: New in DOOM II, tubby Mancubis looks soft, but he packs not one but two plasma guns!

Apogee Software, id's friendly rivals and coheirs of the Wolfenstein legacy, are spinning off a whole new division called 3D Realms specifically to produce 3-D first-person games. Four

games are already in the works, including a 3-D sequel to the popular Duke Nukem. The first of these is scheduled for release at the beginning of 1995. 3D Realms's Build game engine, brainchild of programming wizard Ken Silverman, has all the abilities of the DOOM engine plus a number of incredible additions. Unlike DOOM, Build allows sectors to move. Rooms can rotate or change shape and doors can open in or out instead of only up. It's even possible to create vehicles; one of the forthcoming games has subways and space shuttles. 3D Realms plans to make its own development tools available to registered users, so there will be no need for third-party editors.

Other features of the Build engine include looking up or down, jumping, climbing, crawling, or even flying. Objects can be translucent: A translucent wall becomes a glass window; a translucent monster is a ghost. 3D Realms is already working on Build's successor, Polytex, which will add complete freedom of movement in all directions (picture a game in zero gravity). As usual, when software companies fight it out feature-wise, we, the users, are the real winners. □

tices as its corners. Right-click on the new sector to bring up the Sector Edit dialog box and set the ceiling altitude to 0.

Select the right-side linedef of the door sector and right-click to bring up the LineDef Edit dialog box. Pick one of BIG-DOOR textures (double-click to get a preview) and drag it to the Wall Above slot on the right. Press the small "c" button next to the Wall slot to clear it. Make sure the Length field contains 128. Remove the check next to Impassable and place a check next to Two-sided. Finally, click on the "Doors, msc" option button at the top and select "1=DR Door, closes after 6 sec.", then click Ok. Do the same for the

left side of the door sector.

Now edit the top linedef of the door sector. Be sure its length is 16, check the "Wall Below is unpegged" check box, and drag the DOORTRAK texture to the Wall slot on the right. Press Ok and do the same for the bottom linedef of the door sector. This would be a good time to select Integrity Check from the File menu. If you've done everything right, you'll get the message "Level looks Ok".

But one thing's missing—a way out! In LineDef mode, select the right wall of the right room and split it twice, as we did for the door earlier. Select the middle linedef and right-click to edit its proper-

ties. Drag the SWICOMP texture (the standard end-of-level switch) to the Wall slot on the right and set the Length to 64 (the width of that texture). Choose the Switch option button at the top and select the entry "11=S1 End level. Go to next level."

That's it: You've built a DOOM level. Save it as SIMPLE.WAD, exit Windows, and enter the command

```
DOOM -file SIMPLE.WAD
```

Select New Game, choose the second episode, and wade in. You'll find yourself in a featureless room with a door. Open the door, proceed to the far wall, and flip the switch. Now picture going through this process for the dozens of rooms, doors, halls, staircases, lava pools, and so on in a real DOOM level. □

NEIL J. RUBENKING IS TECHNICAL EDITOR OF PC MAGAZINE.

*The hardest thing
DOOM has to do is
instantly translate the
player's ever-changing
position and direction into
a rendered 3-D view.*

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HARDWARE

Disappointing Display

❓ I have a 386SX/25 with 4MB of memory, a 40MB hard disk, a frame-buffer graphics adapter and a single-speed CD-ROM drive. When I run a full-motion video clip from the CD-ROM, the image—which appears in a tiny window—jitters because so many frames are dropped. I tried increasing the size of the MSCDEX buffer and SMARTDRV but neither change seemed to help. Can you tell me the least expensive way to get closer to 30 frame-per-second (fps) video on this system?

Kevin Wong
San Francisco, California

► **PC MAGAZINE:** That's a tall order. Your system has so many underpowered components, it's unlikely you'll get smooth video playback without major modifications.

The MPC2 specification—which is considered by many to be the *minimum* acceptable configuration for a multimedia system—calls for a 486SX/25 processor, 4MB of memory, a 16-bit sound card, a Super VGA graphics adapter, a monitor capable of displaying 64,000 colors at 640-by-480 resolution, a 160MB hard disk, and a double-speed CD-ROM drive.

Your system runs at the required 25-MHz clock speed, but the 386SX is less powerful than a 486SX and uses only a 16-bit rather than a 32-bit data bus. While you have the obligatory 4MB of memory, tests show that Windows performance improves dramatically when you boost RAM to at least 8MB. Replacing your frame-buffer video card with a Windows graphics accelerator would certainly improve performance, too. A local-bus card would help even

more, though—but that would require a new motherboard. The hard disk specification is meant to ensure adequate file storage, so although your drive is smaller, it should be fine if you've got the room to run Windows and other applications. Your CD-ROM, however, is capable of only half the speed the standard demands. To run a 30 fps video clip in even a 1/16 window (160 by 120 pixels) with only 256 colors, a machine must move over 500KB of data per second, as the following formula shows: $(160 * 120 \text{ pixels per frame} * 8 \text{ bits per pixel} * 30 \text{ fps}) / (8 \text{ bits per byte} * 1,024 \text{ bytes per kilobyte}) = 562.5 \text{ KB per second}$. This exceeds the transfer rate of a double-speed drive. Video clips are often compressed, but even with compression, a minimum MPC2 system will have to struggle to keep up.

So to get satisfactory video clip performance on your system, you'll probably need a new motherboard and CPU, more memory, a faster graphics adapter, and a double-speed CD-ROM. Perhaps the simplest solution is just to buy a new system with the appropriate configuration. It won't be inexpensive, but you can find completely configured multimedia systems that exceed the MPC2 specification for less than \$1,500.

—Alfred Poor

Packed Portable

❓ I have a Tandy notebook computer with a 60MB Conner hard drive that is now hopelessly inadequate for my needs even when I use a disk compression utility. The notebook's setup utility doesn't refer to any hardware expansion features, since it automatically senses the presence of additional memory or an internal modem. When the hard disk is replaced, the computer does not recognize the new drive, nor is there any way to enter its specifications. Is there any way to upgrade the hard disk on this computer?

David Smith
Auckland, New Zealand

► **PC MAGAZINE:** Unfortunately, notebook computers are not designed to be upgraded in the same relatively easy manner as desktop systems. In particular, hard disks are often installed with proprietary and unique arrangements, making upgrades difficult to impossible.

There are some companies that will install larger hard disks in a notebook. Two companies that offer hard disk upgrades for laptops are Computer Products Plus (800-274-4277, 714-418-1400) and Laptop Solutions (800-683-6839, 713-798-0878). However, there's another solution worth considering. You can add an external hard

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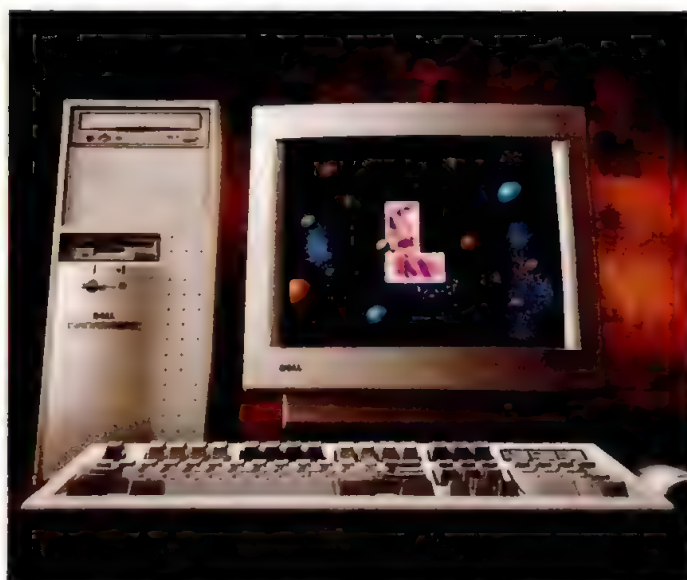
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disk that connects either to the computer's parallel port or (on newer machines) via a PCMCIA card slot. Data transfer rates are slower than with an internal hard disk, but you can minimize the performance hit by placing frequently used files on the internal hard disk and relegating less needed information to the external hard disk. There are even battery-powered external units if you need something you can use on the road. An external drive has an additional benefit: It can make transferring large files to a desktop system quick and easy.—*Alfred Poor*

■ OPERATING ENVIRONMENTS

Serial Numbers and Volume Labels

❓ Every time I format a disk, I get a serial number. How do I format a disk without the serial number? How do I eliminate the serial number from a disk I've already formatted?

*Joseph P. Kresl
Cleveland, Ohio*

❓ Just what is a volume serial number? What does the number mean? Why do

some disks have them and some not? Is there any way to utilize this number?

*Art Dominguez
Panhandle, Texas*

❓ I know that the DOS LABEL command places a disk's label in the boot sector and that all characters are uppercase. Some older versions of the Norton Volume Label utility allow lowercase characters in volume labels. When viewing the boot sector with a hex editor, the characters entered in lowercase appear as 00 hex. Where is the lowercase label stored, and how does the DOS DIR command

find it? Also, how is the serial number determined when a disk is formatted? Is it tied in some way to either the date or time of formatting?

*Stephen R. Bird
Phoenix, Arizona*

► **PC MAGAZINE:** Starting with DOS 4.0, the FORMAT command adds a serial number to every disk. This number doesn't occupy any disk space that you could use for other purposes. If a disk doesn't have a serial number, it was formatted by an earlier version of DOS. The purpose of the serial number is to help programs determine when the user switches floppy disks. The only way to get rid of the serial number on a disk is to reformat the disk with a DOS version before 4.0, but there's really no need—it's harmless.

The serial number value is computed from the date and time the disk is formatted. Each pair of digits in the serial number is the sum of part of the date and part of the time, expressed in hexadecimal notation. The first two digits are the month plus the seconds; the second two are the day plus the hundredths of a second. The third pair of digits is the hour plus the high byte of the year, and the last pair is the minutes plus the low byte of the year. There's no way to reverse this calculation and derive the date and time of formatting based on the serial number, though. (Thanks to Team Borland volunteer Kurt Barthelmess for this information!)

The serial number is stored in a disk's boot sector, along with a copy of the volume label. The actual volume label exists as an entry in the disk's root directory. The LABEL command changes both; the

Our Advisors

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other utility apparently can only change the directory entry. Since DOS doesn't recognize lowercase letters for filenames, directory names, or volume labels, it's not a good idea to force the issue!

For those interested in making use of serial numbers, I'm including my SERIAL.EXE program (written in Borland Pascal) in the files associated with this article. Download it from PC MagNet archived as SERIAL.ZIP and use it to set any disk's serial number to a particular value; you might even choose a hex number that spells something in English, such as FEED-FACE or COFF-EEEE.—Neil J. Rubenking

Assigning File|Run to an Icon

I've tried many different approaches to assigning Program Manager's File|Run menu command to an icon, to no avail. I assume that it is a program on disk somewhere, but I haven't been able to find it. Is this possible?

John P. Hamilton
Dublin, Ohio

►**PC MAGAZINE:** When you select Run from Program Manager's File menu, no separate program is invoked. Rather, a message goes to Program Manager itself telling it to display the Run dialog box. To

associate this command with an icon, you need to write a program that sends the same message to PROGRAMAN. This does not have to be a big, complicated program.

Figure 1 is a Borland Pascal for Win-

```
PROGRAM FileRun;
USES WinTypes, WinProcs;
VAR ProgManH : HWND;
BEGIN
  ProgManH := FindWindow('PROGMAN', NIL);
  IF ProgManH <> 0 THEN
    SendMessage(ProgManH, WM_COMMAND, 107, 0);
  END.
```



Figure 1: The tiny Pascal program FILERUN.PAS invokes Program Manager's Run dialog box.

```
Option Explicit
Declare Function FindWindow Lib "User" (ByVal lpClassName$, ByVal lpWindowName$)
Declare Function SendMessage Lib "User" (ByVal hWnd$, ByVal wParam, ByVal
wParam$, ByVal lParam)
Global Const WM_COMMAND = &H111

Sub Main ()
Dim ProgManH%, Success%
ProgManH = FindWindow("ProgMan", 0)
If ProgManH <> 0 Then
  Success = SendMessage(ProgManH, WM_COMMAND, 107, 0)
End If
End Sub
```



Figure 2: The program BFILERUN accomplishes the same purpose as FILERUN.PAS but is written in Visual Basic.

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1765GM, 17", 28DP, SVGA 1280x1024, NI	\$635

NEC Multisync 4FGe

2V, 14", 28DP, 1024x768 NI	\$324
3V, 15", 28DP, 1024x768 NI	\$454
SVGA, 14", 28DP, 1024x768 NI	\$305
3FGe, 15", 28DP, 1024x768 NI	\$549
4FGe, 15", 28DP, 1024x768 NI	\$579
5FGe, 17", 28DP, 1024x768 NI	\$955
5FGe, 17", 28DP, 1280x1024	\$1,069
6FGe, 21", 28DP, 1280x1024	\$1,959
XE15, 15", 28DP, 1024x768, NI	\$529
XE17, 17", 28DP, 1024x768, NI	\$969
XE21, 21", 28DP, 1280x1024	\$1,919
XP15, 15", 28DP, 1024x768, NI	\$639
XP17, 17", 28DP, 1280x1024, NI	\$1,189
XP21, 21", 28DP, 1600x1200, NI	\$2,359

NOKIA Multigraph 449E

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447L 17", 28DP, 1024x768, NI	\$695
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CONTROLLERS

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1522 SCSI Direction Kit: 16 Bit Standard	
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ST-3660A / ST-3550N	\$295 / \$359
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ST-4185N / ST-42100N	\$1,099 / \$1,399
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BC 500LAN / 800LAN	\$119 / \$209
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OMNI 1250LAN	\$549
OMNI 1600LAN / 2000LAN	\$739 / \$829

Smart Series Intelligent UPS Systems	
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Smart Ups	
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T1910CS Dual Scan 486SX/33, 200MB	\$2,919
T1960 CS Dual Scan 486DX2/50 200MB	\$2,379
T1950 CT Active Matrix Color 486/DX2	
40MHz, 4MB, 200MB Hard Drive	\$2,929
T3600CT Active486DX2/50 250MB	\$4,069
T4700 CS Dual Scan 486/DX2/50 320MB	\$3,369
T4700 CT Active Dockable 486/DX2/50 320MB	\$4,999
T4800 CT Active Intel 486/DX4/75 500MB	\$5,689

EPSON

700C Dual Scan Passive 120MB	\$1,999
700C Dual Scan Passive 210MB	\$2,255
700C Dual Scan Passive 260MB	\$2,295
700CX Active Matrix 120MB	\$2,419
700CX Active Matrix 210MB	\$2,659
700CX Active Matrix 260MB	\$2,699
750 D/S 486 DX2/50 4MB/280 w/ modem	\$2,519
750 D/S 486 DX2/50 8MB/340 w/ modem	\$2,749
750 Active Matrix 486 DX2/50 8MB/340 w/ modem	\$2,779

NEC

Versa S 486/33, 4MB, 210HD, Dual Scan	\$2,329
Versa S 486/33, 4MB, 210HD, Active Color	\$3,229
Versa S 486/50, 4MB, 260HD, Active Color	\$3,709

TEXAS INSTRUMENTS

TM 4000, 486 DX2/50 200MB Dual Scan	\$2,267
TM 4000, 486 DX2/50 Active Color 4MB/200MB	\$2,839
TravelMate 4000E Win DX4/75 340MB	\$3,585
TravelMate 4000E Win DX4/75 455MB	\$4,929
TM4000M Multimedia with PCMCIA slot	
486SL, 50MHz, 200MB Dual Scan	\$2,757
486SL, 50MHz, 310MB Active Color	\$3,345
486SL, 75MHz, 340MB Active Color	\$4,959

SPEAKERS

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ACS-3 NEW

ACS-50 Computer Speaker System	\$175
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ACOUSTIC RESEARCH

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YAMAHA

Yamaha Digital Speakers	
YST-M10H / YST-M5	\$77 / \$50
Powered Subwoofer YST-MSW10	\$149
YST-SS1010 (M10 splr & MSW10 subwtr)	\$219
YST-SS510 (M5 splr & MSW10 subwtr)	\$179

dows program that will do the job. It uses the Microsoft Windows API function FindWindow() to get the window handle for Program Manager; then it uses the SendMessage() API function to send the same message that would be sent by selecting Run from the File menu. (A little sleuthing revealed that the ID for that menu choice is 107.) Figure 2 is the same program implemented in Visual Basic. You can download these source code files and the corresponding compiled .EXE files from PC MagNet's Utilities/Tips Forum archived as FILRUN.ZIP.

Note that if you're interested only in the .EXE file, you should use the Pascal version, FILERUN.EXE. It's less than one-third the size of the Visual Basic version (BFILERUN.EXE) and does not depend on any external files. (Like other Visual Basic programs, BFILERUN.EXE requires VBRUN300.DLL.) Place the program's icon in a Program Manager group and double-click on it to bring up the Run dialog box.—Neil J. Rubenking

WORD PROCESSING

Merging Cells Vertically in a WinWord 6.0 Table

TIP Microsoft Word for Windows 6.0 lets you merge cells horizontally but not vertically. This means you can easily create tables like the top one in Figure 3, with multiple columns grouped under one cell and a centered heading. It's much harder to create the bottom table in the figure, with multiple rows also grouped together and with text in one cell that's taller than any row. As the figure demonstrates, however, you can create the same effect.

The cells that seem to be merged vertically in the bottom table in Figure 3 are actually text boxes, a feature provided by WinWord's drawing tools. Each text box is a little less than two cells high, so the top and bottom edges of the text box fit inside the lines that mark the top border of the top cell and the bottom border of the bottom cell. The text boxes sit on top of the table in a drawing layer but move with the table, so you can edit your document without having to adjust their positions.

To create a table like the bottom one in the figure, first create the table grid,

Region	Thrd Quarter		Total Year to Date
Eastern	Widgets	343	1012
	Gadgets	362	1123
Western	Widgets	221	668
	Gadgets	243	712

Figure 3: Microsoft Word for Windows can't merge cells vertically, which normally limits you to the format shown in the first column in the top table here. As the bottom table shows, however, you can get the same effect by using text boxes.

then add all text and formatting that might affect the height of the rows and, therefore, the size of the text boxes. Next, turn on WinWord's Drawing Toolbar, either by clicking on the Drawing button on the Standard Toolbar or by choosing View | Toolbars and making sure the Drawing check box is checked. Next, click on the Text Box button and draw the text box inside the cells you want to merge vertically. (Note that to draw a text box, you must be in Page Layout view. If you're not, WinWord will offer to switch to Page Layout view when you click on the button.)

After you draw the box, make sure it's still selected and choose Format | Drawing Object. Go to the Fill tab and set Color to White and Patterns to None, then go to the Line tab, set Line to none, and choose OK. You can now insert text or a picture in the text box as the finishing touch.

Petr Toman
Czech Republic

► **PC MAGAZINE:** This can be a very useful technique, but be aware that the reason it works so well—with the text box moving with the table—is that the default vertical position for drawing objects in WinWord is relative to the paragraph the object is in. If you've changed this default to be relative to the margin or page, the text box will not move with the table unless you change the setting back to Paragraph.

To play it safe, when you set the color, patterns, and line for the text box, you should also go to the Size and Position tab and make sure that the Vertical setting in the Position group box is relative to paragraph, as defined in the vertical From box. Note too that you can change the default

settings for drawing objects, so you won't have to change settings for each text box. Simply make sure you don't have a drawing object selected, then choose Format Drawing Object and make whatever changes you like in the Drawing Defaults dialog box.

Keep in mind that when moving or resizing a text box with a mouse, the box or size will normally snap to an invisible grid. This can make it easier to keep text boxes in line verti-

cally, but if you need to move in smaller increments, hold the Alt key down to move smoothly with the mouse. Finally, note that if you switch back to Normal view, the text boxes will disappear from your screen. Don't let that throw you; the text boxes are still there, as you can prove by switching back to Page Layout view or by printing the table.—M. David Stone

SPREADSHEETS

A Mountain of Possibilities

During breaks from my word processing and spreadsheet activities, I often spend time doing crossword puzzles. I thought it would be interesting to try some permutations to solve for missing words, but in putting this onto Microsoft Excel, I ended up with something that seemed very complex.

I wanted to find all the combinations that formed words (acceptable to my dictionary) from *aerotherapeutic*. The words may not be proper nouns, and they must be at least three letters long. Is there any way to do this? Can I set up a program in Microsoft Excel 5.0 to look at all the combinations for words of any size?

Ed Balchen
Edmonton, Alberta, Canada

► **PC MAGAZINE:** Before one tries to scale a mountain, one ought to know its elevation. The number of ways in which a 15-letter word can be rearranged is 15! (15 factorial), which is the product of every integer from 1 to 15 or

15*14*13*12*11*10*9*8*7*6*5*4*3*2*1

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MidWest Micro packs its Elite Systems with savage elements like monstrous hard drives, roaring RAM and FREEky software. With their incredible speeds and endless expansion possibilities, you won't feel strapped down by these immortal Elites. So charge yourself up with one of MidWest Micro's Elite Systems today.

If they'd only had Pentium power, he would've turned out right...

Frankenstein's creators didn't have the advantage of Pentium technology - but

MidWest Micro does! And you can bet your tombstone we used it to create a monster machine just for you. In fact, constructing the perfect computer was simple using Pentium technology. By combining intelligence, photographic memory and the ability to do two things at once, MidWest Micro's flawless Elite Pentium Processor Based Systems came alive.

In fact, Igor says the Pentium processor is over 300 times faster than the first PC micro-processor.



Monster Machine

Mind-Blowing PCI

Stop experimenting – Elite's PCI Systems passed all the tests. With superior compatibility and high-speed data handling, it doesn't take a lab technician to figure out these systems move fast. Plus, the 32-bit data path is perfect for full-motion video and peripheral expansion. (Just think – Frankenstein could've expressed himself much better had they only added a fax modem!) Elite PCI Systems definitely spark some serious interest – order yours now.

The Perfect Equation

One of MidWest Micro's most exciting creations is our line

of Elite Home PCs. Ideal for everyone, the Home PCs are bubbling over with features like a double speed CD-ROM drive, 16-bit sound card, digital quality speakers and Microsoft 3-disk CD-ROM software library. And if you're just starting out, the Elite Slimline Value Home PC has all the right parts. Its high-speed RAM, sleek case design and free software really tip the scale in your favor.

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You don't have to travel all the way to Transylvania to get an Elite System. A toll-free phone call connects you directly to the MidWest Micro Castle. So flip the switch and order your Elite today.



One look at Elite's Pentium Processor Based System...and even old Frank turns green with envy.

Featuring electrifying speeds and super-scalar technology, only Pentium offers the power jolt your computing needs. And for a real charge — just eye MidWest Micro's shockingly low price!

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If the thought of losing battery life on a dark stormy night makes you feel weak in the knees – don't panic. Featuring Advanced Power Management and nickel-metal hydride battery, Elite Notebooks let you compute up to 50 percent longer than silly ghouls using other notebooks.

Scared you might run out of storage space? Not a ghost of a chance. Elite Notebooks and SubNotes are available in a variety of hard drive configurations – even 720 Mb! Plus, the Elites' PCMCIA slots make adding LAN adapters, fax modems and flash memory easier than ever.

Dare to enter a new dimension of computing – open up to the Elite Pentium SoundBook, SoundBook and 486SX SubNote now.

**Mismatched
Michael**
PCMCIA slot
wasn't
his type

**Flat
Fred**
Run over
on the
information
highway

A Halloween-themed graveyard scene. In the background, a skeleton in a white sheet holds a glowing lantern. In the foreground, a witch with a pointed hat and a broom is visible behind a black metal fence. Tombstones are scattered throughout, some with humorous epitaphs. Bare tree branches are visible against a dark, starry night sky.

Drained Darryl

The battery life on his Elite lasted longer than he did.

Businessman Bob

Died from watching one too many Wall Street

286 System

Survived by loving 386, 486 and Pentium relatives



MidWest Micro's Supernatural SubNote

EVERY GHOST IN THE GRAVEYARD'S GOT ONE

No bones about it, every cool ghoul owns an Elite 486SX SubNote. This 3.9 lb. thriller is lurking with features like upgradeable RAM, a large hard drive and Advanced Power Management. In fact, the Elite's nickel-metal hydride battery lets you compute up to five hours on a single charge. (That ought to lift anyone's spirits!)

Available with a 260, 340 or 520 Mb hard drive, the 486SX SubNote also comes with a large 9.5" monochrome or dual-scan color screen. Perfect for word processing and DOS applications, the monochrome screen delivers spine-tingling display. But if black and white gives you the creeps, get the Elite with dual-scan color.

Bury yourself in the feature-filled Elite SubNote from MidWest Micro. Call us today....or else!



Elite 486SX SubNote

- ▶ Intel 486SX SL-Enhanced Processor
- ▶ 4 Mb RAM (expands to 12 Mb)
- ▶ 9.5" Mono or Dual-Scan VGA Display
- ▶ Turbo Bus Accelerated Video
- ▶ 3.5" External Disk Drive
- ▶ User Replaceable Hard Drive
- ▶ One Type II PCMCIA Slot
- ▶ Built-in Trackball
- ▶ NiMH Battery & AC Adapter
- ▶ Advanced Power Management with SMM
- ▶ One Parallel & One Serial Port
- ▶ External VGA & Keyboard Port
- ▶ MS-DOS 6.22
- ▶ Weight: 3.9 lbs.
- ▶ Carrying Case
- ▶ One Year Manufacturer's Warranty

Monochrome SubNote

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486SX-33 with 340 Mb HDD & PCMCIA 9624 S/R Fax Modem #007307 **\$1499**

Options

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8 Mb RAM Card	#005971	\$469
Car Adapter	#005972	\$ 65
PCMCIA 9624 Fax Modem	#001722	\$135
PCMCIA 14.4 Fax Modem	#001812	\$179
PCMCIA Ethernet Adapter	#001832	\$159

Dual-Scan Color SubNote

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It'll Rattle Your Bones

Dying for a notebook with built-in sound capabilities? MidWest Micro's Elite SoundBook is a real scream! Featuring a microphone, speakers and bundled audio software, this powerful notebook is waking the dead.

Whether you're a zombie, a human or a two-headed monster, MidWest Micro knows everyone's computing needs are different. And that's why you get to choose the processor, hard drive and screen that best suits your needs. For those of you interested in a little black magic, the monochrome screen offers drop-dead display. But if you'd like to add some orange to that black - choose the active-matrix or 10.3" dual-scan color screen.

Be the ghost with the most - order your Elite SoundBook now!



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- ▶ 3.5" Built-in Disk Drive
- ▶ User Replaceable Hard Drive
- ▶ Two Type II/One Type II PCMCIA Slot
- ▶ Built-in Trackball
- ▶ NiMH Battery & AC Adapter
- ▶ Advanced Power Management
- ▶ One Parallel & One Serial Port
- ▶ External VGA & Keyboard Port
- ▶ MS-DOS 6.22 & WFW 3.11
- ▶ Lotus Organizer
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- ▶ Carrying Case
- ▶ One Year Manufacturer's Warranty

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DX4-75 with 340 Mb HDD & 12 Mb of RAM #008011 **\$2799**

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DX2-66 with 520 Mb HDD & 8 Mb of RAM #008015 **\$1999**

DX4-75 with 520 Mb HDD & 8 Mb of RAM #008016 **\$2199**

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PCMCIA 9624 Fax Modem	#001722	\$135
PCMCIA 14.4 Fax Modem	#001812	\$179
PCMCIA Ethernet Adapter	#001832	\$159

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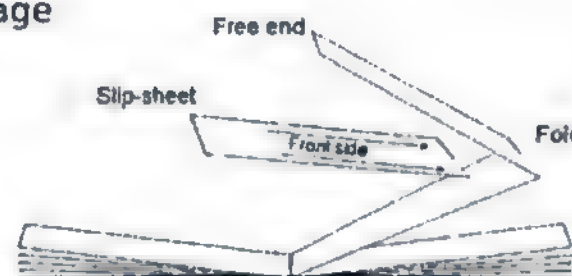
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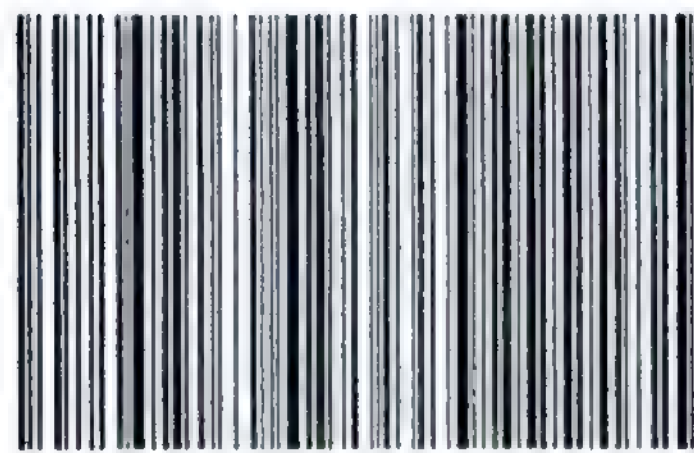
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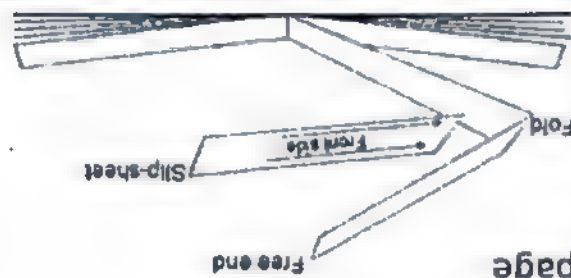
Foldout slip-sheet



Inverted Foldout slip-sheet

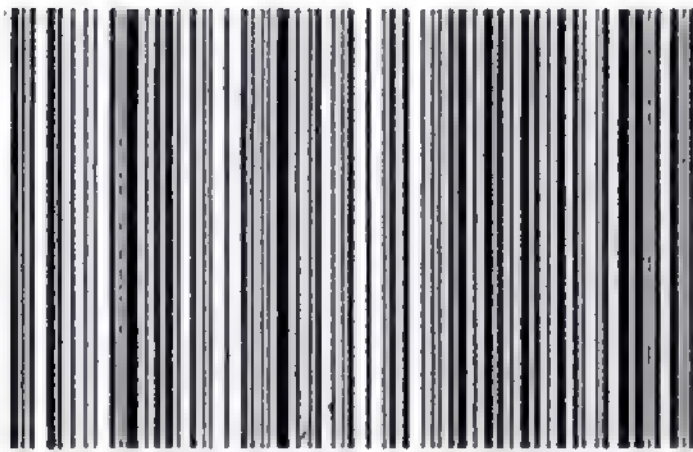
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GbsSlipBack-0018

Back

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Here's a real treat – now you can experience the power of Pentium in the **NEW** Elite Pentium SoundBook. Even demons and vampire bats can't stand up to *this* monster of a notebook! With the Elite's hair-raising 90 MHz processing speed and PCI Local Bus, mobile computing takes on a whole new presence.

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- ▶ PCI Local Bus Video with 1 Mb Video DRAM
- ▶ PCI Local Bus HDD Controller
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AD#G11

Total letters	Letters used	Number of possibilities
15	15	1.30767E+12
15	14	1.30767E+12
15	13	6.53837E+11
15	12	2.17946E+11
15	11	54486432000
15	10	10897286400
15	9	1816214400
15	8	259459200
15	7	32432400
15	6	3603600
15	5	360360
15	4	32760
15	3	2730
Total:		3.55463E+12

Figure 4: A 15-letter word can form the number letter combinations shown here for each word length.

In Excel, you can use the formula

=FACT(15)

to find out how large a quantity that is. It comes to something in the neighborhood of 1.3 quadrillion.

The number of 14-letter permutations available in a 15-letter word is the same as the number of 15-letter permutations. The number of 13-letter permutations is half as large. In general, the number of m -letter permutations in an n -letter word is

$$\frac{n!}{(n-m)!}$$

The table in Figure 4 gives you an idea of the elevation of Mr. Balchen's "peak." The table shows that there are enough possibilities to populate nearly a million Excel worksheets from A1 to IV16384. Some of the outcomes would

be identical, because several letters in *aerotherapeutic* occur more than once. But the number of unique outcomes is still Himalayan, if perhaps not astronomical.

Clearly, we can't ask Excel to find and spell-check every possibility. Nevertheless, there are some ways your spreadsheet can be helpful.

Here's one way to go about it. Start by entering the word *aerotherapeutic* (or whatever other word you want to probe) in cell A1. Next, select A2:A16,

type =RAND() and press Ctrl-Enter. That puts a random number in each cell in A2:A16. Next, in B2, type the formula

=MID(\$A\$1,RANK(A2,\$A\$2:\$A\$16),1)

Now copy B2 into B3:B16. At this point, the values of cells B2:B16 constitute one 15-letter permutation of the original word. Each formula in B2:B16 uses MID in conjunction with RANK to pluck a different letter from the word in A1. Every time you recalculate this worksheet, the order will change.

You could lean on the F9 key and eyeball the changing values of B2:B16 to try to find words you hadn't already thought of. But with the help of a few more formulas, Excel's spell-checker, and a macro, you can automate the process a bit more.

In C2, type the formula

=B2&B3&B4

This will generate a label consisting of the first three characters of the current permutation. In C3, type

=B2&B3&B4&B5

to concatenate the first four characters. Move on down column C, continuing in this manner as far as you like or until you have concatenated all 15 letters. Now assign the name Candidates to the entire range of your concatenation formulas. Assign the name Solutions to another cell at or near the top of the worksheet—E1, perhaps. Finally, use the Insert | Macro | Module command and type the macro shown in Figure 5. (If you're not working on Sheet1, substitute the appropriate sheet name in the line that ends with the Calculate method.)

This macro will populate your Solutions range with words acceptable to Excel's spell-checker. If you prefer, you can download the Excel 5.0 file WDPERM.XLS from the Sol:Spreadsht/DBMS section of PC MagNet's Utilities/Tips Forum. Warnings and disclaimers: Using the spell-checker is time-consuming. This is a coffee-break macro. Also, successive calls to the spell-checker consume memory. If you ask for a large number of solutions, the macro will probably halt at some point with a Runtime error message. When that happens, you'll need to click End to clear the message, save your worksheet, then close and restart Excel.

Finally, the macro as written doesn't concern itself with duplications (you may turn up the same legal word more than once), and the spell-checker doesn't know a proper noun from an improper one. But, what the heck: It's fun to watch, and we didn't promise you Mount Everest!

—Craig Stinson

Dim Found As Integer, Wanted As Integer

Sub GetSolutions()

Wanted = Application.InputBox("How many solutions do you want?", , , , , 1)

Found = 0

Do While Found < Wanted

Sheets("Sheet1").Calculate

For CellToCheck = 1 To Range("Candidates").Rows.Count

CandidateString = Range("Candidates").Cells(CellToCheck, 1).Value

If Application.CheckSpelling(CandidateString) = True Then

Found = Found + 1

Range("Solutions").Cells(Found, 1).Value = CandidateString

End If

Next CellToCheck

Loop

End Sub



Figure 5: This Excel 5.0 macro, included in the file WDPERM.XLS, determines which letter combinations are words acceptable to the spell-checker.

■ DATABASES

Delete Confirmation Refinement

TIP I read the Solutions tip in your July 1994 issue regarding a potential problem with accidental deletions for users of both Paradox for Windows and WordPerfect for Windows. Thanks for the neat tip. I develop applications for a group that uses

WordPerfect for Windows, and was not aware of this trap! I'm grateful that *PC Magazine* found the space to run this very important article.

After I read the tip, I typed in the code as it appears in the magazine and was showing it to a user. I opened a form and moved to the last record of the table, record #90009. Then I pressed Ctrl-Del to demonstrate the feature. My user liked it and asked that I implement it as soon as possible. Next I pressed the Esc key to clear the dialog box from the screen, but instead of remaining on record #90009, I ended up on record #90008—and #90009 was deleted. This reveals a small problem with the code as printed—pressing the Esc key does not cancel the record deletion.

The solution is to modify the code and change the line that reads

```
if msgQuestion("Are you sure  
you want to delete this record?")  
= "No"
```

to

```
if msgQuestion("Are you sure  
you want to delete this record?")  
<> "Yes"
```

This way the user *must* choose "Yes" to delete the record. Anything else, including pressing Esc, will cancel the deletion and return the user to the original record.

*Rich Keagy
via CompuServe*

► **PC MAGAZINE:** Nice work. The ObjectPAL msgQuestion procedure displays a Yes button and a No button and returns "Yes" or "No" according to which button you press. But if you press Esc, double-click the System menu, choose Close from the System menu, the msgQuestion function returns "Cancel", which trips up the original code. Because the original code looks only for a "No" response from msgQuestion, anything else, including "Cancel", gets treated as a "Yes". Mr. Keagy's fix turns this around, making sure only a "Yes" response actually deletes the record.

If you make the change suggested by Mr. Keagy to the action and the two

KeyPhysical methods in the original listings, you won't have to worry about accidentally deleting a record with the Esc key. You can also download the updated version of DELDLG.ASC from PC MagNet. Look in the Spreadsh/DBMS library of the Utilities/Tips forum.

—*Sal Ricciardi*

■ GRAPHICS

.GIFs That Move

❓ I was viewing some .GIF files, and unexpectedly one of the files became animated. How was this done and how can I create this type of .GIF file?

*Duane Schenone
Toms River, New Jersey*

► **PC MAGAZINE:** The .GIF file format is very robust. Not only does it provide some of the best compression (the .GIF format was developed by CompuServe to facilitate efficient transfer of pictures by modem) and one of the more stable file formats around (incompatibility messages are almost nonexistent with .GIF files), but it is extensible. Your surprise animation was in the GIF89a format, which supports multiple images in a single file. Multiple-image .GIF files are very similar to the frames of a traditional movie, where individual pictures are displayed at a relatively high speed—so quickly in fact that your brain perceives the difference between the pictures as motion. Remember that to achieve the illusion of movement, each image must be only slightly different from the preceding picture.

Many raster-based graphics programs, like Adobe Photoshop and Aldus PhotoStyler, can create single-image .GIF files. To create multiple-image GIF files, however, requires specialized software. The \$28 CompuMake, from Canyon State Systems Software (602-282-5070), is a very powerful collection of graphics routines that let you string multiple .GIF files together. It handles a number of other procedures as well, such as converting between different raster file formats, resizing images and—the thorniest of all problems—conflicting color palettes.

All .GIF files are limited to a 256-color palette. Viewing sequential images with

wildly different colors often results in palette remapping, where all of the colors in a picture go weird while a new palette is loaded. CompuMake addresses this problem with the ability to generate a global palette from multiple images. CompuMake's power comes in only one form: a DOS-based, command line interface. This means you must type commands using the correct syntax at the C:\ prompt. Obviously, this is a program intended for programmers, power users, and computer graphics enthusiasts.

Once you've created a multiple .GIF file with CompuMake, you should be able to use any compliant .GIF viewer to play your animation. You can download shareware .GIF viewers, such as CompuShow (\$25 for 5.25-inch disks or \$26 for 3.5-inch disks), from Library 3 in the Graphics Support Forum on CompuServe (Go GraphSup).

Embed is another program that lets you combine multiple .GIFs into a single file, and it's a little less rigorous than CompuMake. Although DOS-based, Embed can work in conjunction with simple ASCII scripts. If you've ever edited a Windows .INI file, you'll probably feel comfortable with Embed's scripting format, which is essentially a list of external files and instructions for things such as screen placement. Embed interprets the script and compiles all of the individual elements into a single file.

Embed offers an additional benefit: You can incorporate sounds (in the form of .WAV and MIDI files) for a full multimedia experience. In fact, you'll discover just how powerful the MIDI format really is, because all of the timing instructions in the file (such as when to display a picture or play a sound) are based on the ticks and beats of the MIDI file itself.

The only way to play back the multimedia .GIF files you've created with Embed is to use a companion player program that runs under Windows, MMGIF .EXE. Though MMGIF will allow you to scroll through a .GIF file page by page, you need a sound card and a MIDI sequencer to get the full effect. Both Embed and MMGIF are freeware programs available in Library 10 of the Sight and Sound Forum on CompuServe (Go SS-Foru).—*Luisa Simone*

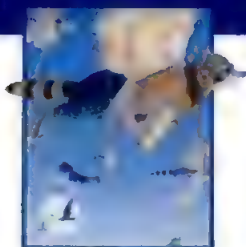


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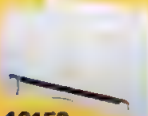
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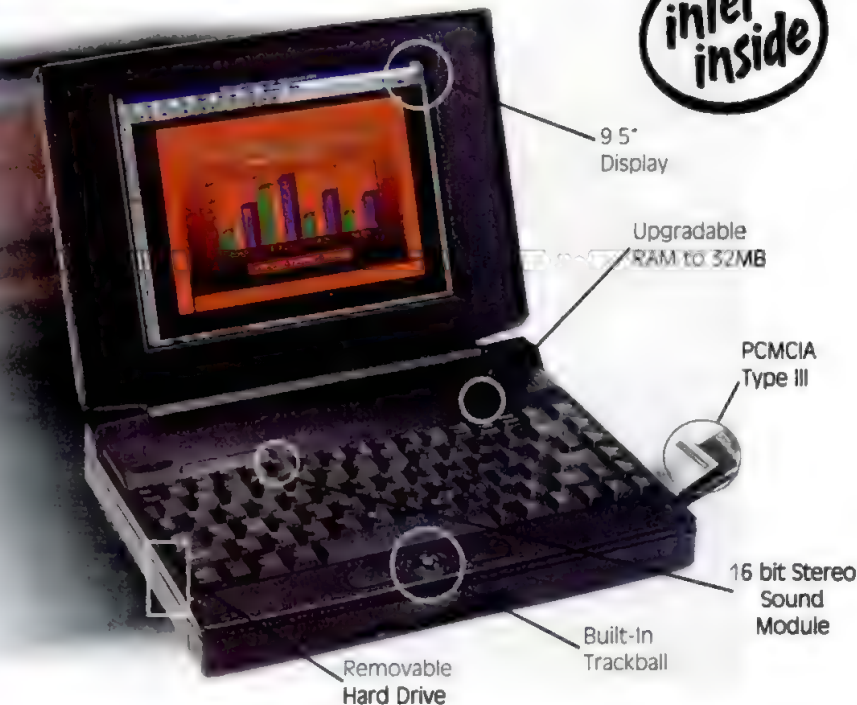
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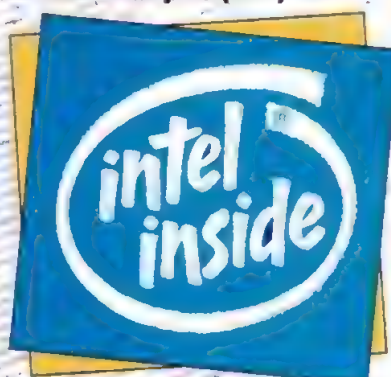
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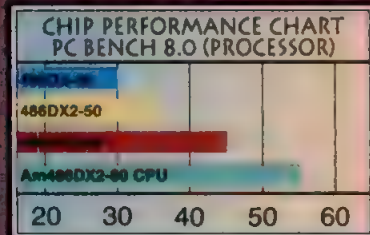
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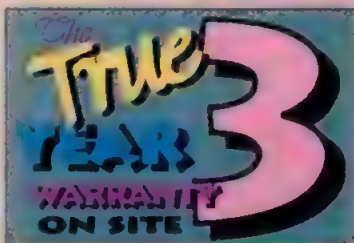


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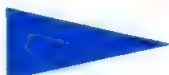
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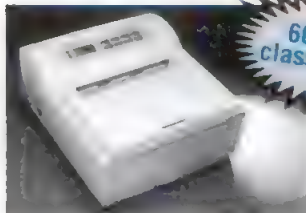


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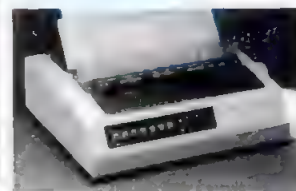
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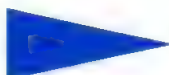
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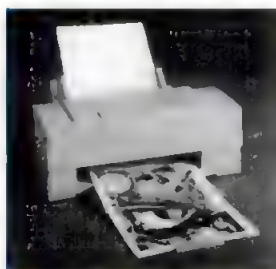


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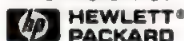
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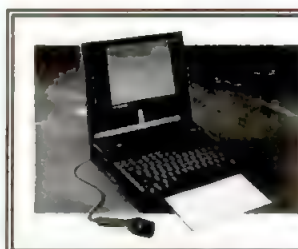
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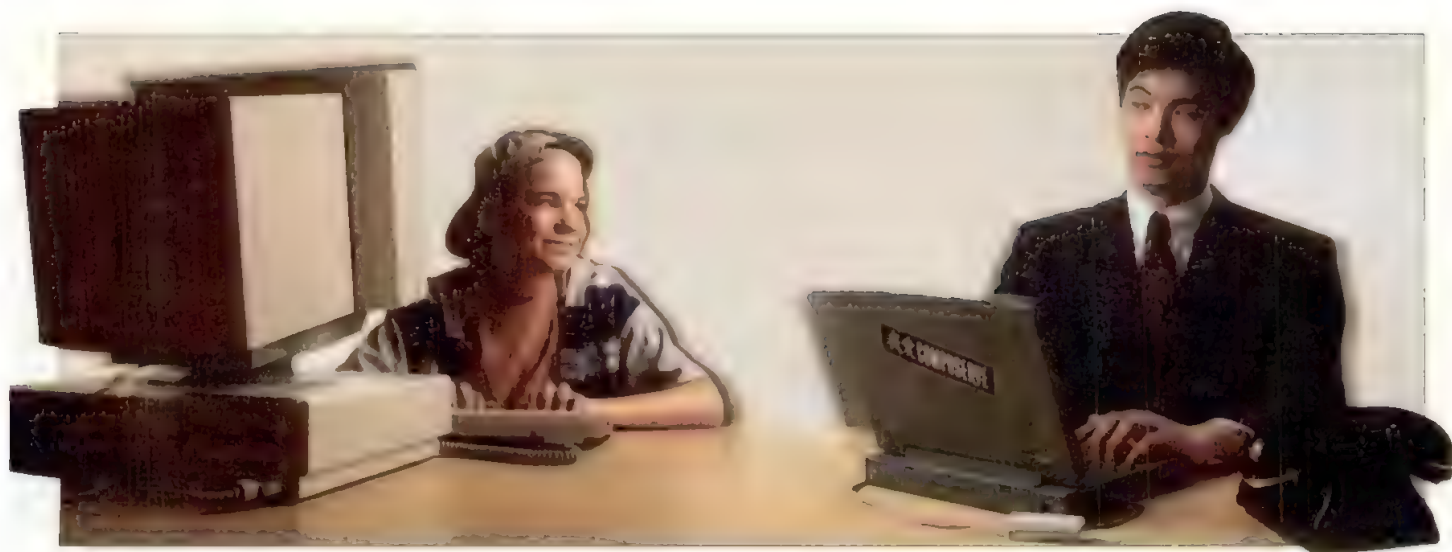
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Toshiba Direct

Portégé T3400

- ▲ Ultra-portability at only 4.1lbs
- ▲ 4MB RAM, expandable to 20MB
- ▲ PCMCIA Type II slot
- ▲ External 3.5" disk drive
- ▲ Integrated AccuPoint pointing device

Model	Processor	Screen	Hard Drive	Price
T3400CT	486SX33	7.8" Active	250MB	\$2899
T3600CT	486DX2/50	8.4" Active	250MB	\$4069

Lease for \$106/mo.

T4700 and T4800

- ▲ 8MB RAM, expandable to 24MB
- ▲ Brilliant 9.5" color display with local bus video
- ▲ 2 PCMCIA slots (Type II, Type III)
- ▲ Microsoft Sound System, built-in microphone, audio out port
- ▲ MS-DOS, UltraFont, Indeo video compression software, Windows for Workgroups 3.11

Model	Processor	Screen	Hard Drive	Price
T4700	486DX2/50	9.5" Active	200MB	\$4549
T4700	486DX2/50	9.5" Active	320MB	\$4899
T4800	486DX4/75	9.5" Active	500MB	\$5599

Lease for \$166/mo.

as low as
\$4549

T2400

- ▲ 486DX2/50 processor
- ▲ 2 PCMCIA slots (Type II, Type III)
- ▲ Integrated AccuPoint pointing device
- ▲ Optional sound card
- ▲ MS-DOS, Windows for Workgroups

Screen	Hard Drive	Price
9.5" Dual Scan	250MB	\$2929
9.5" Dual Scan	320MB	\$3089
8.4" Active Color	250MB	\$3639
8.4" Active Color	320MB	\$3799

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PRODUCT**

T2400

Satellite Notebooks

- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ Type III PCMCIA slot
- ▲ 82-key keyboard
- ▲ MS-DOS, Windows 3.1
- ▲ Ballpoint mouse with Quickport Enhanced power management

Model	Processor	Screen	Hard Drive	Price
T1910	486SX/33	9.5" Mono	200MB	\$1499
T1910	486SX/33	9.5" Dual scan	200MB	\$2039
T1960	486DX2/50	9.5" Dual scan	200MB	\$2379
T1960	486DX2/50	9.5" Dual scan	320MB	\$2629
T1960	486DX2/50	8.4" Active color	200MB	\$3029
T1960	486DX2/50	8.4" Active color	320MB	\$3259

Lease for \$55/mo

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T1910

TOSHIBA



XJACK 14.4/14.4 MODEM

\$219.99

Modem	Description	Price
XJ1144	14.4/14.4 XJACK	\$219.99
CC3144	14.4/14.4 PCMCIA	\$219.99
XJ2144	14.4/14.4 XJACK GOLD	\$249.99
CC4144	14.4/14.4 PCMCIA GOLD	\$249.99

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Stylus 800 180cps 360dpi 100 Sheets \$269.99
ActionLaser 1500 6PPM 300dpi \$619.99
ActionLaser 1600 6PPM 600dpi \$999.99

Magnavox

14" SVGA, 1024x768ni, 28mm \$279.99
15" SVGA, 1280x1024ni, 28mm \$379.99
17" SVGA, 1024x768ni, 31mm \$689.99
20" SVGA, 1280x1024ni, 31mm \$1089.99

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cellular modems**

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PCMCIA



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SAFEJACK
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14.4/14.4
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with Voice Mail!**

\$149.99



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LANTastic V6.0- 1 User	\$79.99
LANTastic V6.0- 5 User	\$329.99
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Eagle NE200T PCMCIA Ethernet	\$199.99

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4MB Memory Upgrade for Toshiba 4700, 4800	\$249.99
4MB Memory Upgrade for Compaq Concerto	\$249.99
4MB Memory Upgrade for Compaq Prolinea	\$219.99

MiniStor

MiniStor 260MB Drive PCMCIA Type III	\$339.99
MiniStor 340MB Drive PCMCIA Type III	\$439.99
DockIt Socket PCMCIA, Drive Bay Adapter	\$99.99
260MB Drive PCMCIA, III, w/DockIt Socket	\$399.99



AST Value



Ascentia 900N
10.4" Active Matrix screen
now available!

Ascentia 900N

- ▲ 486DX2/50 or 486DX4/75 processor
- ▲ 4MB/8MB RAM exp. to 32MB
- ▲ Large Dual Scan or Active color display
- ▲ PCMCIA type III slot

Model	Screen	Hard Drive	Price
4/50 Model 343W	10.3" Dual scan	340MB	\$3329
4/50 Model 343W	9.5" Active	340MB	\$4869
4/75 Model 343W	10.3" Dual scan	340MB	\$3969
4/75 Model 513W	10.4" Active	510MB	\$5799

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Ascentia 900

Bravo LC Desktops

New Generation!

- ▲ 4/8MB RAM exp. to 64MB
- ▲ VESA local bus graphics
- ▲ 1MB video RAM
- ▲ MS-DOS 6.2, Windows 3.1
- ▲ Energy Star Compliant

Model	RAM	Hard Drive	Price
4/33s Model 173W	4MB	170MB	\$1099
4/33s Model 273W	8MB	270MB	\$1369
4/50s Model 173W	4MB	170MB	\$1249
4/50s Model 273W	8MB	270MB	\$1509
4/66d Model 273W	8MB	270MB	\$1779
4/66d Model 543W	8MB	540MB	\$2039
4/100t Model 273W	8MB	270MB	\$2149
4/100t Model 543W	8MB	540MB	\$2299

Lease for \$50/mo.

AST Color Monitors start at \$369.99

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Bravo MS desktops!**



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Ascentia 800N

- ▲ 486SX/33 or DX2/50 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 9.5" Dual Scan color display
- ▲ PCMCIA Type III slot

Model	Hard Drive	Price
4/33s Model 253W	250MB	\$2299
4/33s Model 343W	340MB	\$2499
4/50d Model 253W	250MB	\$2599
4/50d Model 343W	340MB	\$2739

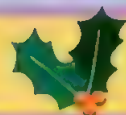
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Ascentia 500s

- ▲ 486SX/33 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 250MB or 340MB removable hard drive
- ▲ 2 Type II or 1 Type III PCMCIA slot
- ▲ External 3.5" floppy drive
- ▲ SmartPoint Trackball
- ▲ 3 Year Warranty

Screen	Hard Drive	Price
9.5" Dual Scan	250MB	\$2259
9.5" Dual Scan	340MB	\$2479

Lease for \$50/mo.



Zenith Data Systems



Z-STAR EX Notebook

High-end features at a low-end price!

- ▲ Cyrix 486DX2/50 processor
- ▲ 4 or 8MB RAM expandable to 20MB
- ▲ Modular design with removable hard drive & floppy drive
- ▲ 32-bit VESA local bus graphics, 512KB video RAM
- ▲ Two Type II or one Type III PCMCIA slot
- ▲ Modem/audio module available
- ▲ Enhanced J-Mouse pointing device
- ▲ Built-in AC adapter
- ▲ MS DOS, Windows 3.1 and CoSession Host software
- ▲ 1 Year Z-CARE on-site service

Processor	RAM	Screen	Hard Drive	Price
486DX2/50	4MB	9.5" mono	200MB	\$1699
486DX2/50	4MB	9.5" dual scan	200MB	\$2179
486DX2/50	8MB	9.5" dual scan	340MB	\$2549
486DX2/50	4MB	9.5" active	340MB	\$3309

as low as

\$1699



Z-NOTEFLEX Multimedia Notebook

Modular architecture for a multitude of user-upgradable features.

- ▲ User upgradable processor, memory, hard drive, display and more
- ▲ 4 or 8MB RAM expandable to 24MB
- ▲ 32-bit VL local bus video
- ▲ Detachable video display
- ▲ Built-in 16-bit stereo sound with speaker and microphone
- ▲ Integrated trackball
- ▲ Two Type II or one Type III PCMCIA slot
- ▲ MS-DOS, Windows for Workgroups, Microsoft Sound System
- ▲ 3-Year Warranty

Processor	RAM	Screen	Hard Drive	Price
486DX2/50	4MB	10.3" dual scan	200MB	\$2869
486DX2/50	4MB	10.3" dual scan	340MB	\$3149
486DX2/50	4MB	9.5" active	340MB	\$4339
486DX2/50	8MB	9.5" active	450MB	\$4759
486DX4/75	8MB	9.5" active	520MB	\$5339

as low as
\$2869



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A complete portable multimedia solution for any PCMCIA notebook!

- ▲ Integrated double-speed CD-ROM drive, 16-bit stereo sound, speakers & audio in/out ports
- ▲ PCMCIA Type II interface included
- ▲ Upgrade any notebook with PCMCIA to a full multimedia machine in one easy step



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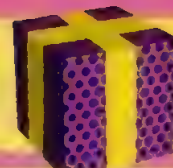


Z-NOTEFLEX ACCESSORIES

FLEXDOCK port replicator	\$219.99
FLEXBAY floppy bay/battery recharger	\$159.99
FLEXSHOW Multimedia Companion	\$799.99
FLEXSITE LCD Display Stand	\$199.99

CIRCLE 268 ON READER SERVICE CARD

NEC: Versatility



UltraLite Versa V

- ▲ 486DX2/50
- ▲ 4MB expandable to 20MB
- ▲ 2 Type II PCMCIA slots
- ▲ MS-DOS 6.2, Windows 3.1, built-in trackball
- ▲ Removable hard drive
- ▲ Removable floppy – add second battery

Screen	Hard Drive	Price
9.5" Dual scan	250MB	\$2839
9.5" Active	250MB	\$3619
9.5" Active	340MB	\$3799
9.5" Active	540MB	\$4279

Lease for \$104/mo.

\$2839



Versa V

Versa M

- ▲ 486DX4/75 or 486DX4/100 processor
- ▲ 2 Type II or 1 Type III PCMCIA slots
- ▲ Removable hard drive
- ▲ Removable screen
- ▲ Integrated speaker, microphone
- ▲ MS-DOS, Windows 3.1, Windows Sound System, Video for Windows Run-Time

Processor	Hard Drive	Screen	Price
486DX4/75	340MB	9.5" Dual Scan Color	\$3899
486DX4/75	540MB	9.5" Active Matrix Color	\$5199
486DX4/100	810MB	9.5" Active Matrix Color	\$6049
486DX4/75	540MB	9.5" High Res. Active	\$5579
486DX4/100	810MB	9.5" High Res. Active	\$6429
486DX4/75	340MB	9.5" True Color Active	\$5099

Lease for 143/mo.

UltraLite Versa S

- ▲ 486 processor
- ▲ 9.5" screen
- ▲ SurePoint integrated pointing device
- ▲ 2 Type II PCMCIA slots
- ▲ Only 4lbs.

Processor	Screen	Hard Drive	Price
486SX/33	9.5" Mono	210MB	\$1889
486SX/33	9.5" Dual Scan	210MB	\$2319
486SX/33	9.5" Active	210MB	\$3219
486DX2/50	9.5" Active	260MB	\$3689

Lease for \$69/mo.

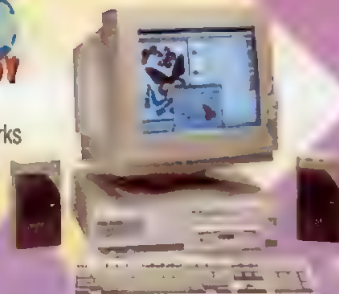
Ready Multimedia Desktops

- ▲ 486 processor
- ▲ VESA local bus graphics
- ▲ NEC CD-ROM drive
- ▲ SoundBlaster 16 sound card
- ▲ Speakers, microphone
- ▲ 24/96 fax modem
- ▲ MS-DOS, Windows, Quicken
- ▲ CD titles: Compton's Encyclopedia, PFS Window Works

Processor	Hard Drive	Price*
486SX/33 desktop	270MB	\$1349
486DX2/66 desktop	340MB	\$1539
486DX2/66 minitower	420MB	\$1639

*NEC monitors start at \$339.99

Lease for \$50/mo



MultiSync Monitors

3V

\$469.99

- ▲ 15" SVGA
- ▲ 1024x768, .28mm NI
- ▲ 72MHz VESA refresh
- ▲ MPR II, EnergyStar

2V-14" SVGA-\$339.99



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MultiSpin CD-Rom Drives

MultiSpin 4X

600KB/sec transfer rate, 220ms access time, Available stand-alone or with a 16-bit interface card and Microsoft Encarta.

MultiSpin 3Xp Plus

500KB/sec transfer rate, 240ms access time, Portable and streamlined for the notebook user. These models include a SCSI-2 interface and are available stand-alone or with a 16-bit interface card and Microsoft Encarta.

MultiSpin 2V

300KB/sec transfer rate, 320ms access time, IDE interface included, Simple Start, Installation Kit and Microsoft Encarta included.

2V Deluxe version includes Creative Labs SoundBlaster 16 soundcard, Speakers, batteries and the best selling titles MYST and SimCity.

Multiscan 15sf
15" SVGA
1280x1024ni, .25mm

\$449.99



SONY

Trinitron Multiscan Monitors

17" SVGA 1024x768ni 23mm	\$939.99
17" SVGA 1600x1280ni 23mm	\$979.99
20" SVGA 1600x1280ni 30mm	\$1889.99

MobileMax PCMCIA Drives!

MobileMax 131

\$339.99

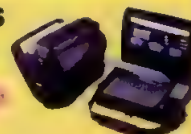


Maxtor

345MB IDE Drive, Enhanced Kit	\$199.99
546MB IDE Drive, Enhanced Kit	\$299.99
131MB PCMCIA Drive, Type III	\$339.99
171MB PCMCIA Drive, Type III	\$389.99

Luxurious Leather

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Premier Leather

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- ▲ IBM 486BL/50 processor
- ▲ 4MB RAM exp. to 20MB
- ▲ 200MB hard drive
- ▲ 7.7" color display
- ▲ Type II PCMCIA slot
- ▲ TrackPoint II integrated pointing device
- ▲ 3.5" external floppy drive
- ▲ Weighs only 3.8 lbs.
- ▲ IBM DOS 6.3, Windows 3.1, Lotus cc:Mail, Organizer, ScreenCam, Official Airline Guide FlightDisk, CoSessions Host, Prodigy, America Online, and FaxWorks 3.0

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ThinkPad®
360

ValuePoint® SpaceSaver Si

- ▲ 4MB RAM exp. to 64MB
- ▲ VESA Local Bus graphics
- ▲ 512KB Video RAM exp. to 1MB
- ▲ 3 expansion slots, 3 drive bays
- ▲ IBM DOS 6.1/MS Windows 3.1, mouse, enhanced 101 keyboard

Processor	Hard Drive	Price
486SX/25	120MB	\$929
486SX/33	212MB	\$1039
486DX2/66	212MB	\$1369

IBM color monitors start at \$349.99

ValuePoint®
Performance



ThinkPad 360® notebooks

**HOT
PRODUCT**

- ▲ 486SL/33 processor
- ▲ 4MB RAM exp. to 20MB
- ▲ Modular design, removable hard drive & floppy drive
- ▲ Local Bus Graphics with 1MB video RAM
- ▲ 2 Type II or 1 Type III PCMCIA slot
- ▲ TrackPoint II integrated pointing device
- ▲ IBM DOS 6.3, Windows 3.1, Lotus cc:Mail, Organizer, ScreenCam, Official Airline Guide FlightDisk, CoSessions Host, Prodigy, America Online, and FaxWorks 3.0
- ▲ Port Replicator and Docking Station available

Screen	Hard Drive	Price
9.5" Monochrome	170MB	\$1939
9.5" Monochrome	340MB	\$2419
9.5" Dual Scan	170MB	\$2519
9.5" Dual Scan	340MB	\$2999
8.4" Active Color	170MB	\$3389
8.4" Active Color	340MB	\$3869

ValuePoint® Performance

Unmatched feature set!

- ▲ 486DX/33, DX2/66, or DX4/100 processor, Pentium upgradable
- ▲ 4/8MB RAM exp. to 128MB
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- ▲ SelectaBus VESA or PCI Bus technology (interchangeable)
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LTE Elite

- ▲ 486 processor
- ▲ 4/8MB RAM, Exp. to 20/24MB
- ▲ Built-in AC adapter
- ▲ Removable hard drive
- ▲ 2 Type II or 1 Type III PCMCIA slots
- ▲ Integrated trackball
- ▲ MS-DOS 6.0, Windows 3.1, MS Video for Windows Runtime

Processor	Display	Hard Drive	Price
486DX2/40	9.5" Dual scan	170MB	\$3119
486DX2/40	8.4" Active	170MB	\$3779
486DX2/40	8.4" Active	340MB	\$4159
486DX2/50	9.5" Mono	250MB	\$3299
486DX2/50	9.5" Active	340MB	\$4999
486DX4/75	9.5" Active	340MB	\$5669
486DX4/75	9.5" Active	510MB	\$6139

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LTE Elite

Contura Aero

- ▲ Type II PCMCIA slot
- ▲ Integrated trackball
- ▲ Weighs only 3.5 lbs. (mono), 4.31 lbs. (color)
- ▲ MS-DOS, Windows 3.1

Processor	Display	Hard Drive	Price
486SX25	8.0" Mono	170MB	\$1139
486SX33	7.8" Passive Color	170MB	\$1699
486SX33	7.8" Passive Color	250MB	\$1889

Lease for \$50/mo.

COMPAQ

as low as
\$1139



Contura Aero

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ProLinea Desktops

- ▲ 4MB RAM expandable to 100MB
- ▲ 3.5" floppy drive
- ▲ Local bus graphics
- ▲ Pentium upgradable
- ▲ Energy Star compliant
- ▲ MS DOS 6.0, Windows 3.1

Processor	RAM	Hard Drive	Price
486SX/33	4MB	200MB	\$1049
486SX2/50	4MB	200MB	\$1169
486DX2/66	4MB	340MB	\$1489
486DX2/66	4MB	525MB	\$1639
486DX4/100	8MB	340MB	\$1999
486DX4/100	8MB	525MB	\$2139

*Compaq color monitors start at \$259.99

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4MB MD		\$159.00	
8MB MD		555.00	
Advantage Pro 486/33, 50/25, Bravo LC			
4MB MD		135.00	
16MB MD		341.00	
Advantage 386SX/20 25 Adv Pro SX/25			
8MB KIT		275.00	
25MB KIT		69.00	
8MB KIT		299.00	
Bravo LC 486/50, 33, 33, 25			
4MB MD		134.00	
8MB KIT		268.00	
16MB MD		519.00	
Prismos			
4MB KIT		164.00	
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8MB KIT		290.00	
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8MB KIT		290.00	
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4MB MD		\$148.00	
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2MB		89.00	
8MB		349.00	
14400, 16400, 17300			
2MB		139.00	
4MB		189.00	
14400, 16400		379.00	
8MB		689.00	
11900, 11950, 14500, 14600, 14700, 14800			
4MB		189.00	

NEC

Ultra Lite Versa	4MB	\$225.00
4MB		399.00
16MB		799.00
UltraLite II SL/25C	2MB	129.00
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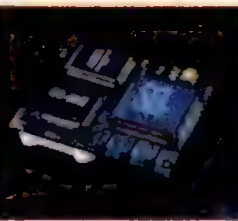
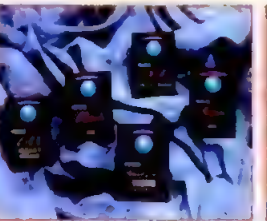
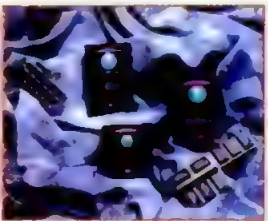
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- 14" SVGA monitor, 28mm non-interlaced
- 7 16-bit ISA slots, 2 with 32-bit VL-Bus extensions
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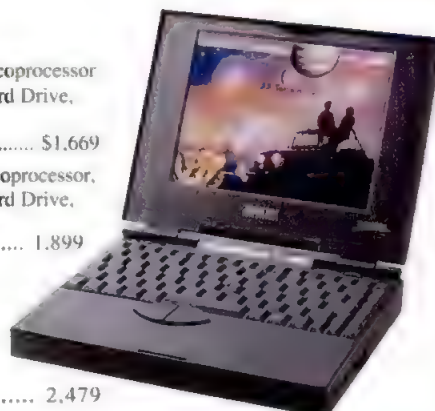
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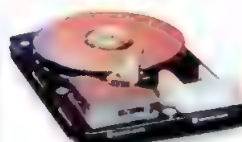
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IBM Token Ring MAU	458.88

intel

EtherExpress PRO Flash 10BT	115.07
EtherExpress PRO Flash 10BT 5pk	482.72
EtherExpress PRO Flash 10BT 20pk	1489.89
EtherExpress PRO Flash combo	113.07
EtherExpress PRO Flash combo 5pk	505.98
EtherExpress PRO Flash combo 20pk	1827.22
EtherExpress 16 coax	99.33
EtherExpress 16 coax 5pk	454.13
EtherExpress 16 coax 20pk	1698.38
EtherExpress MCA coax	188.52
EtherExpress 16 10BT	99.33
EtherExpress 16 10BT 5pk	454.13
EtherExpress 16 10BT 20pk	1698.38
EtherExpress MCA 10BT	166.92
EtherExpress 16 combo	116.77
EtherExpress 16 combo 5pk	549.72
EtherExpress 16 combo 20pk	2034.93
EtherExpress Flash 10BT	111.88
EtherExpress Flash 10BT 5pk	513.62
EtherExpress Flash combo 5pk	129.79
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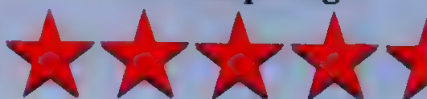
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486DX2	66 MHz	364MB	8MB	1/4	3/2	1 MB	64/256K	64/256K	\$2075
IBM ValuePoint Performance Series Mini Tower - 3.5 3.5 bays are available									
486DX2	66 MHz	364MB	8MB	1/5	4/2	1 MB	64/256K	64/256K	\$2195
486DX2	100 MHz	364MB	8MB	1/5	4/2	1 MB	64/256K	64/256K	\$2665
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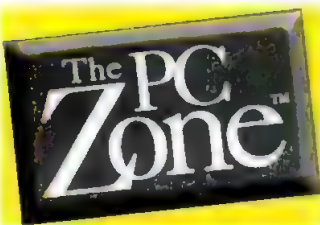
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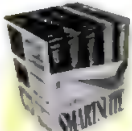
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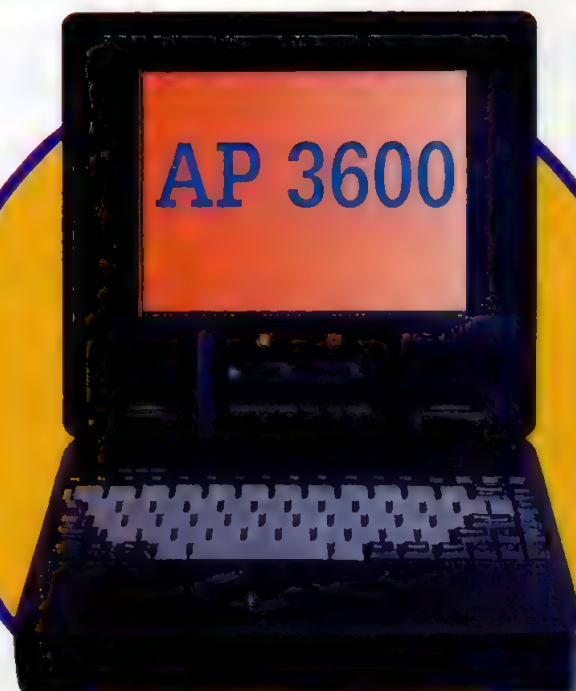
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Diamond Stealth 24 VLB 1MB S3 Chipset #SZVLB1	189
Diamond Stealth 64 VLB #SZVLB) or PCI #S64PCI	299
Diamond Stealth 32 2MB VLB Tseng Labs 32 #SZVLB1	299
Diamond Stealth 32 2MB VLB Tseng Labs 32 #SZPCI	299
Diamond Viper 2MB VRAM Wetek Chipset VLB #VPER2) or PCI #VPERPCI	289
Hercules Stingray Pro VLB #H501) or PCI #H501	99
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Hercules Dynamite Pro VLB or ISA 2MB #H002)	149
Hercules Dynamite Pro Power VLB 2MB #H002) or PCI 2MB #H002)	159
Hercules Graphite Pro ISA 1MB #H310	159
Hercules Graphite Pro VLB 1MB #H510	179
Hercules Graphite Pro VLB or ISA 1MB #HGT2)	239
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EPSON Stylus COLOR Ink Jet 720 dpi, 2 yr. warranty	\$555
EPSON ActionPrinter 3260 affordable dot matrix, 2 yr. warranty	\$185
ActionLaser 1100 300 dpi, 4ppm, 1MB Printer sharing, 2 yr. warranty	\$479
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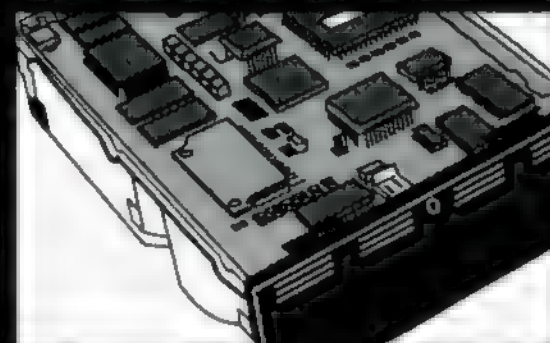
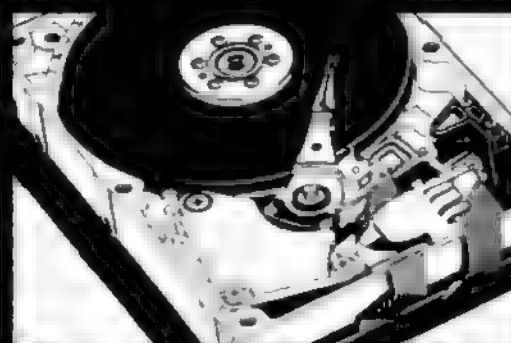


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541MB	12ms	CFA540A	\$279
811MB	10ms	CFA810A	\$399
1080MB	9ms	CFP1080A	\$569

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540MB	12ms	7546A	\$269

MICROPOLIS

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1740MB	10ms	MC2217A	\$899
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420MB	14ms	ST3491A	\$205
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1700MB	9ms	ST11900N	\$1049
2145MB	8ms	ST12550N	\$1229
2148MB	9ms	ST12400N	\$1139
4290MB	9ms	ST15230N	\$2139
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342MB	12ms	LPS340A	\$209
541MB	12ms	LPS540A	\$259
SCSI			
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270MB	12ms	LPS270S	\$195
342MB	12ms	LPS340S	\$235
541MB	12ms	LPS540S	\$269
1080MB	10ms	IMP1080	\$599
1440MB	9.5ms	IMP1440S	\$809
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364MB	12ms	70G8488	\$219
527MB	12ms	70G8486	\$319
728MB	12ms	70G8511	\$399
1052MB	8.6ms	70G8512	\$659
SCSI			
270MB	12ms	94G2439	\$219
364MB	12ms	94G2440	\$259
527MB	12ms	94G2441	\$329
728MB	12ms	94G2422	\$449
1052MB	8.6ms	70G8492	\$659
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PCMCIA drives	Floppy Drives
IBM PS/1, PS/2, and Tandy Drive upgrades	

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NEC	CDR510	3X	195ms	\$299
Toshiba	XM3401	2X	200ms	\$260
Toshiba	XM4101	2X	320ms	\$215
Teac	CD50	2X	265ms	\$209
Media Vis.	SH93R	2X	280ms	\$165
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DRM604X	6 disc	612KB/sec		\$1049
DRM1804X	18 disc	612KB/sec		\$2079
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CD50	\$359	\$485	\$359	\$425
XM3401	\$425	\$549	\$425	\$479
CDR510	\$499	\$619	\$499	\$559
PX43CH	\$659	\$779	\$659	\$699

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A1542CBASIC 16Bit SCSI		\$225	\$215
A2742 EISA SCSI		\$319	\$309
A2842 VESA SCSI		\$279	\$269
Future Domain 1680 16Bit SCSI		\$155	\$139
QLOGIC PCI SCSI & WIDE		\$325	\$309
PCI 4IDE, incl CD ROM & FAST ATA		\$59	\$49
ALPHA RESEARCH CACHING CARDS			
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S475I 32Bit Local Bus IDE		\$139	\$129
S485I 32Bit PCI IDE		\$229	\$219
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2Gig	HP 35470	\$829	\$969
2-4Gig	Conner 3200	\$589	\$739
4-8Gig	Conner 4324	\$859	\$999
4-8Gig	HP 35480	\$929	\$1079
4-16Gig	Sony SDT5000	\$929	\$1079
4-16Gig	Conner 4326	\$969	\$1139
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Toshiba 3401	\$669	\$1499	\$2499
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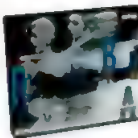
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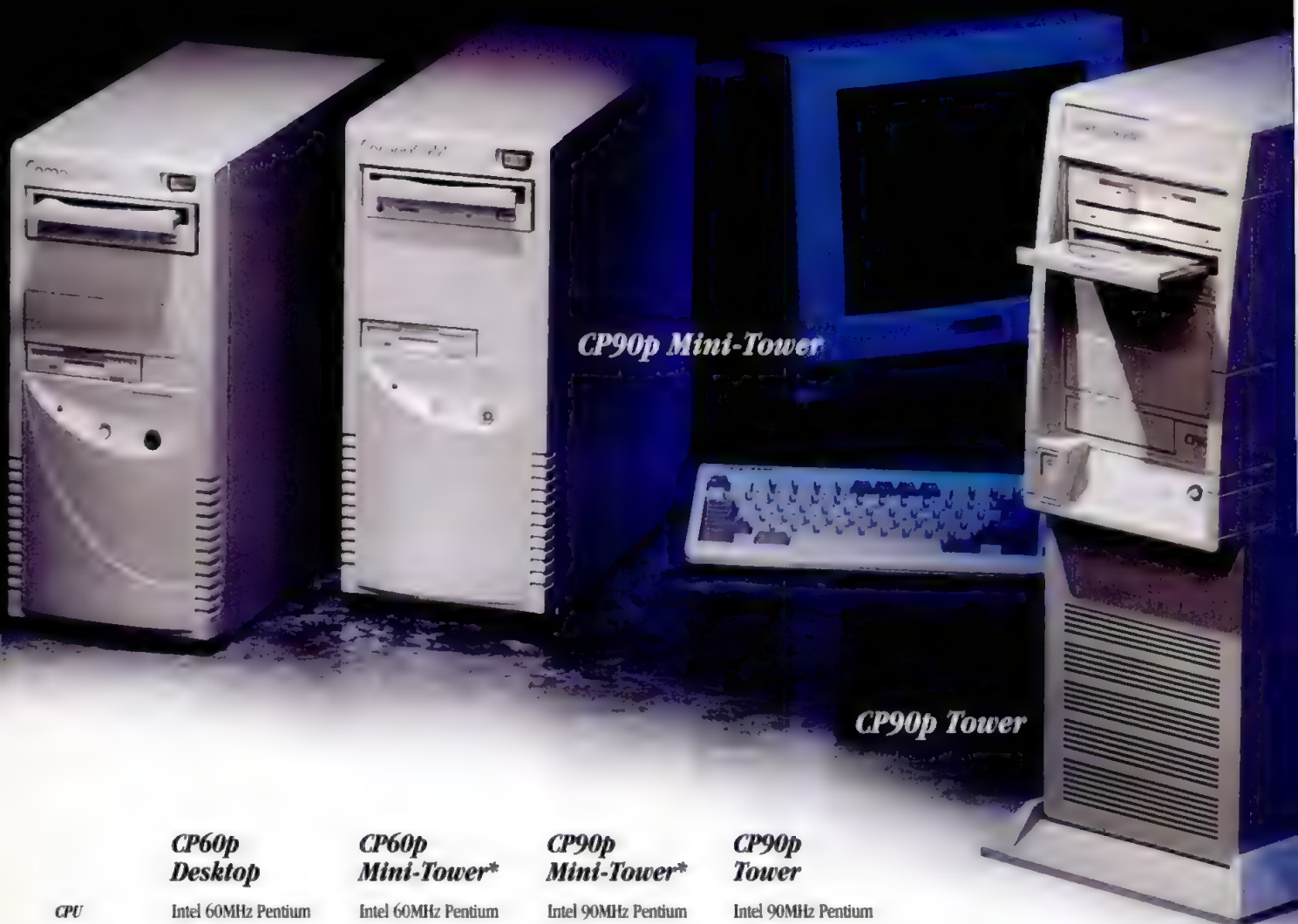
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RAM	8MB
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Expansion	8 Slots, 3 with PCI
Monitor	14" N-I
Video	1MB PCI
CD ROM	Optional
Fax/Modem	No

CP60p Mini-Tower*

CPU	Intel 60MHz Pentium
RAM	8MB
Cache	256KB
Hard Drive	420MB
Expansion	8 Slots, 3 with PCI
Monitor	15" N-I
Video	1MB PCI
CD ROM	Dual Speed MPC2 Compliant
Fax/Modem	Yes

CP90p Mini-Tower*

CPU	Intel 90MHz Pentium
RAM	8MB
Cache	256KB
Hard Drive	420MB
Expansion	8 Slots, 3 with PCI
Monitor	15" N-I
Video	1MB PCI
CD ROM	Dual Speed MPC2 Compliant
Fax/Modem	Yes

CP90p Tower

CPU	Intel 90MHz Pentium
RAM	16MB
Cache	256KB
Hard Drive	1GB
Expansion	8 Slots, 3 with PCI
Monitor	14" N-I
Video	1MB PCI
CD ROM	Dual Speed MPC2 Compliant
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AP3260	179
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IBM ValuePoint

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486DX2/66 8/364MB	1999

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ThinkPad 360 Mono 340MB	2399
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ThinkPad 360C Color 170MB	3299
ThinkPad 360C Color 340MB	3799
ThinkPad 510Cs Color 200MB	1799

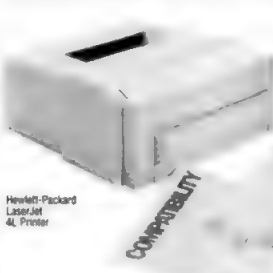
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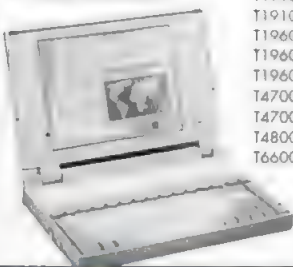
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LaserJet 4MP for MACs	1325
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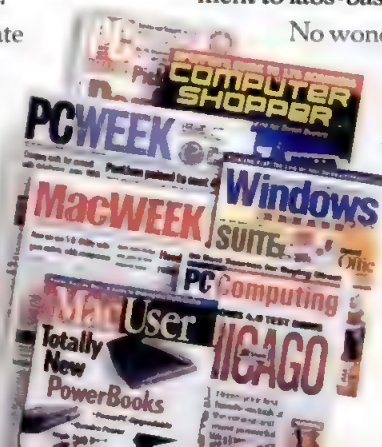
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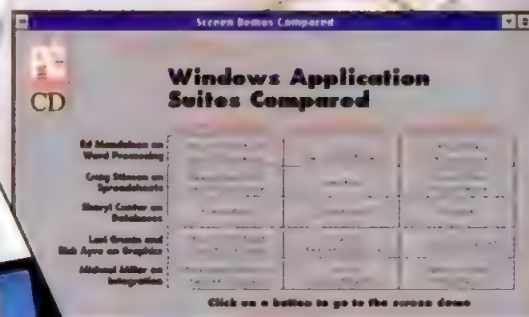
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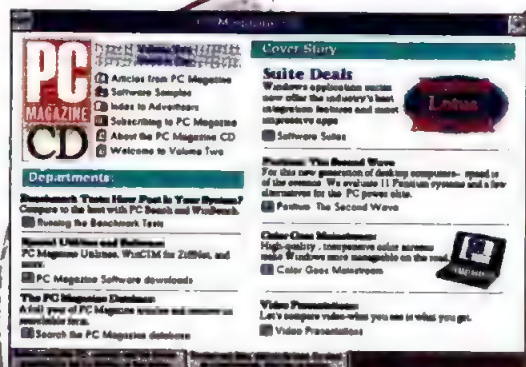
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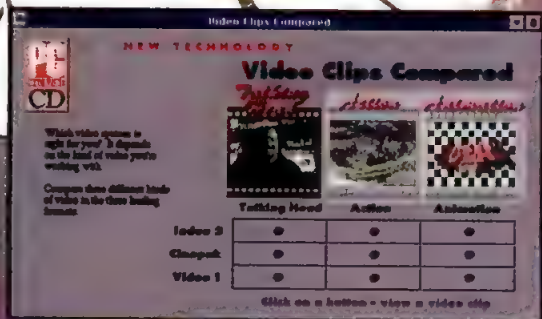
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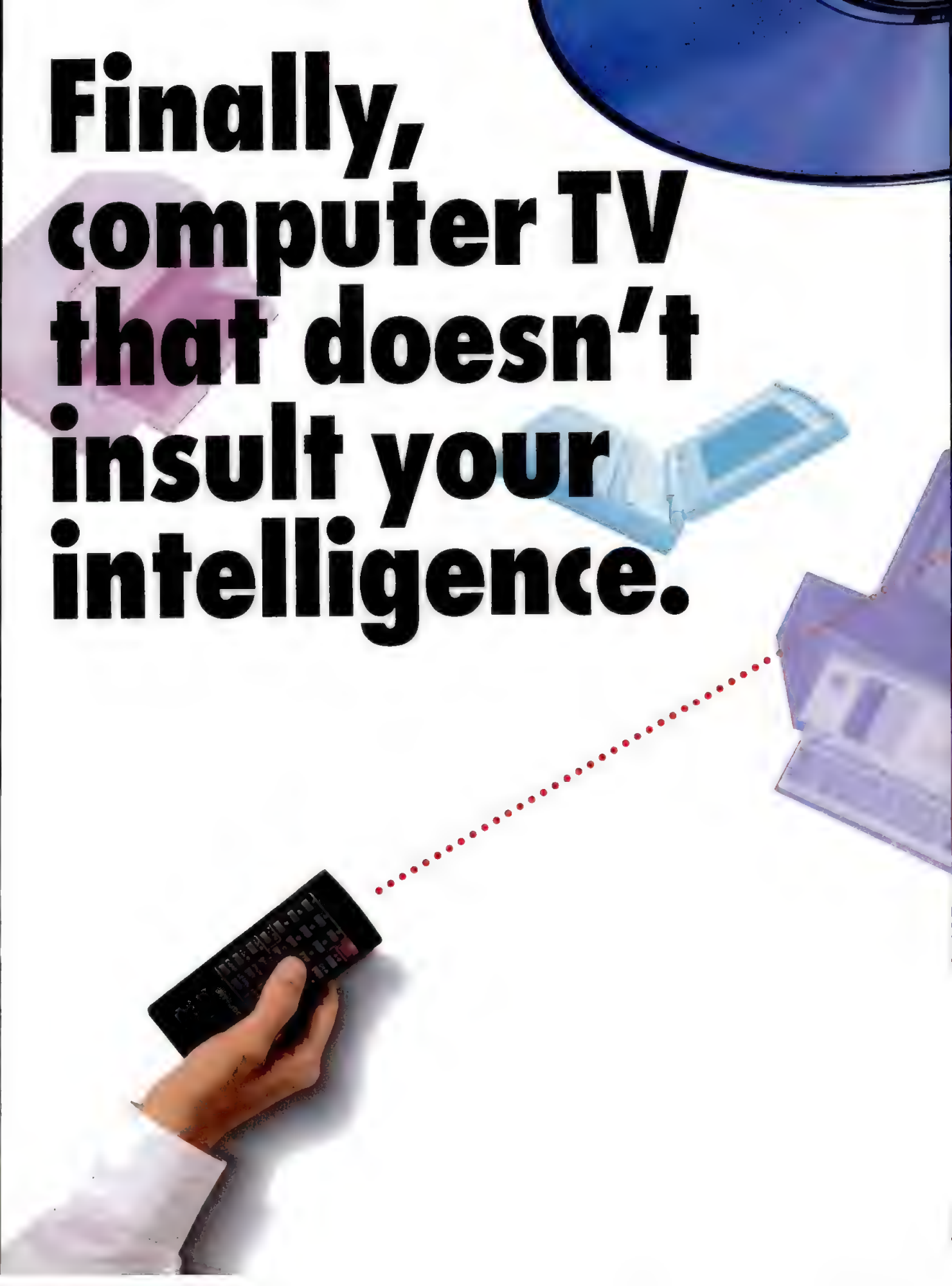
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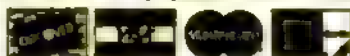
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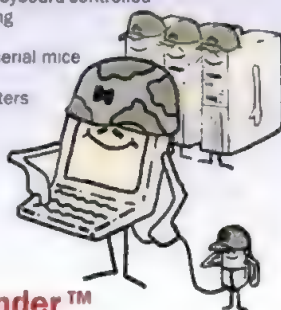
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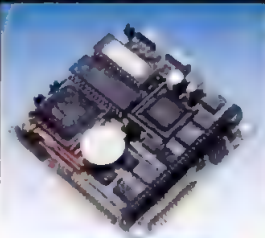


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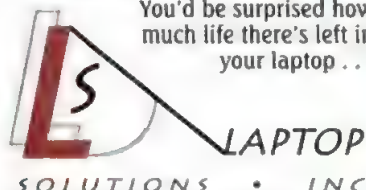
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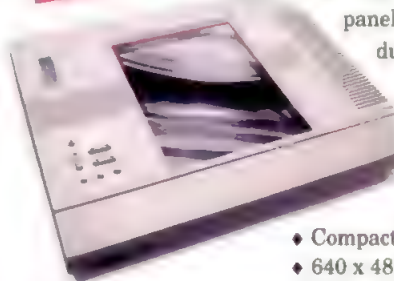
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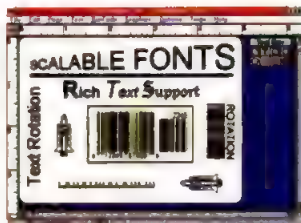
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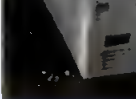
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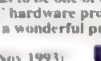
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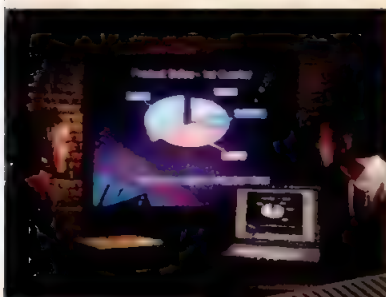
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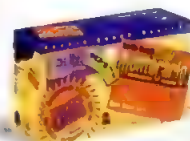
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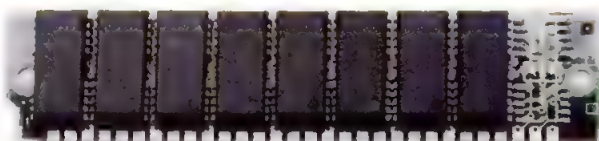
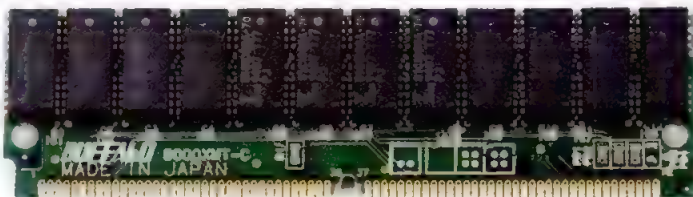
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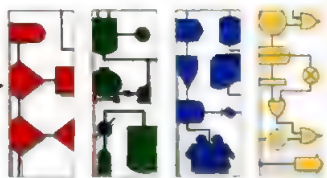
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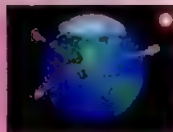


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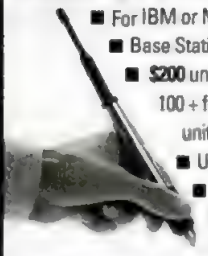
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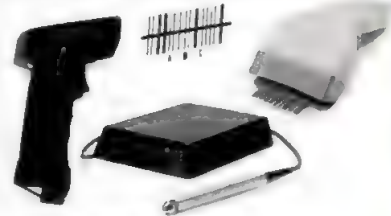
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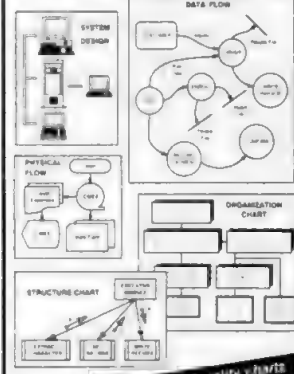
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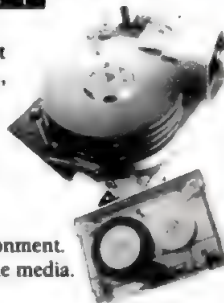
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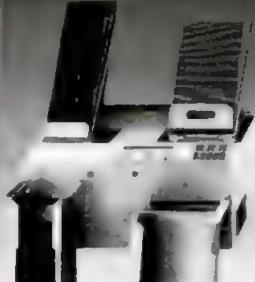
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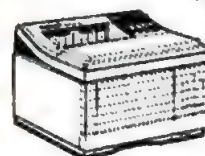
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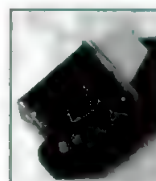
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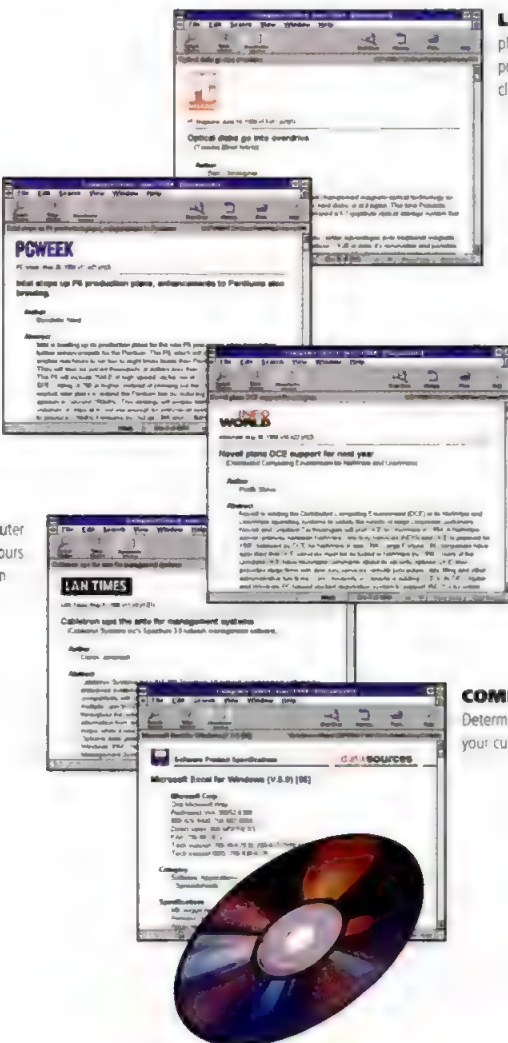
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Coming Up

Printer Blockbuster

Get ready for *PC Magazine's* eleventh annual printer blockbuster! Our writers and PC Labs technicians have spent months testing more than 100 printers, evaluating their output quality, performance, features, and price to help you make an informed choice. We look at all the new offerings in five categories.

Personal/Workgroup Lasers The big story this year is affordability. Prices for laser printers have been trending downward, and you can now get laser output quality for under \$400. We report on almost three dozen laser units, from 4-page-per-minute printers ideal for individuals and home offices to 12-ppm network lasers aimed at workgroup users. We even look at the new color laser printers to see how they stack up against traditional high-end color technologies. Find the right mix of features, speed, and price to fit your needs and budget.

Departmental Lasers Things have come a long way since the only requirements for a network laser printer were a fast engine and a hefty duty cycle. The 13 products we review in this section provide a look at the state of the art: direct connection to the network, bidirectional communications, remote management, and the flexibility to fit varied network environments. Speeds range from a quick 16 ppm to a blazing 32 ppm.

Ink Jets Color was the exception on past ink jets printers; now it's the rule. And for good reason. No other technology delivers such quality output at so affordable a price. For presentation graphics, business proposals, or individual use, this year's crop of ink jets deliver crisp text and vivid color for just a few hundred dollars. Be warned, though: Not all ink jet output is created equal. See which units shine and which fall short.

Color Printers For business and graphics professionals who need flawless four-color output, there's more to choose from now than ever before. Traditional thermal wax and thermal dye technologies are being pressured from below by the upstart ink jet and color laser offerings. How does output quality compare? We'll show you.

Dot Matrix and Line Printers So you think dot matrix is dead? Think again. For individuals who are just starting out in computing, dot matrix printers still offer the most affordable way to get documents onto paper. And for business owners who need to produce letter-quality output at lightning speeds with nominal costs per page, dot matrix and line printers are the only choice. The specialized units we look at can punch through multipart forms and spit out hundred of characters per second, day in and day out.

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After Hours

EDITOR'S RATINGS: ★ Poor ★★ Fair ★★★ Good ★★★★ Excellent



What Do Women Want? Software for Women and Girls

Think of the typical computer user and you probably envision a man. Why? Because software has traditionally been designed for men.

Until recently, there have been precious few titles that give women and girls the incentive to push some pixels. That's starting to change, though, with software developers finally creating titles with female protagonists and sensibilities.

The four titles included here feature themes of interest to females of all ages. They may vary in their approaches, but all leave room for improvement.

Hawaii High: Mystery of the Tiki

Sanctuary Woods Multimedia Corp.; 415-578-6340.

Circle 482 on reader service card

★★★ \$39.95

Hawaii High is a classic case of a great idea hindered by less-than-stellar execution. The package aspires to be a digital Nancy Drew story, but the result more resembles

an awkward Saturday morning cartoon.

The story is a simple one: Classmates Jennifer and Maleah become partners in mischief when they investigate the mystery behind an ancient Tiki that washes ashore. Although the game is structured much like the Choose Your Own Adventure series of children's novels, the story here is too basic and one-dimensional, and the dialogue is too stilted to appeal to today's sophisticated audience. Those children on the lower end of the suggested age range are more likely to find this game appealing.

In addition to the story, there is an on-line guide-

book and short videos that provide definitions and demonstrations of Hawaiian culture and mythology, and simple puzzles pop up every so often. Beware: If you fail to solve one of the puzzles, you're back to the start of the game! So save often to avoid falling victim to this design flaw.

The game, which provides little supporting documentation and insufficient on-line help, is at times difficult to navigate—even for an adult. And while the comic-feel of the veteran comic illustrator Trina Robbins' still-frame drawings adds a dash of realism, the drawings fill only a portion of the screen.

Although one run-through of Hawaii High could be harmless fun, and the concept is an appealing one, Hawaii High just doesn't have enough meat to sustain a repeat performance.

—Melissa J. Perenson

Hello Kitty Big Fun Storymaking

Big Top Productions Inc.; 415-978-5363.

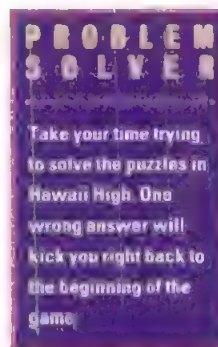
Circle 483 on reader service card

★★★★ \$24.95

Few characters are more familiar to little girls than Hello Kitty, few activities more appealing than storytelling. Combine the two and you have a product that's sure to be a favorite.

The biggest draw to this story-creation package is its protagonist: Hello Kitty, star of pencil cases, backpacks, makeup sets, and, now, software.

Young storytellers can interact with one of two stories to determine what exactly Hello Kitty does in her day. In one of the stories, kids get to choose which ingredients Hello Kitty will include in her stew. In the other, they decide where she will go, how she will get there,



Proteen girls can follow along as Hawaii High's explorers unearth the mystery of the Tiki.

AFTER HOURS INDEX

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After Hours



Hello Kitty, star of pencil cases, makes her digital debut in Big Fun Storymaking.

and what she'll do once she arrives at her destination.

To create a story, children listen to the narration and then fill in the blanks that determine Hello Kitty's actions. To do this, kids choose from a palette of icons. Passing the mouse over these icons elicits a spoken description, so even children who can't yet read can create their own stories, then have Hello Kitty read it all back to them. What the children may miss, though, are the hotspot animations that are popular in other digital storybooks but are absent here.

The illustrations are lovely and stick to the spirit of the original, nondigital designs.

What Hello Kitty Big Fun Storymaking does, it does extremely well. Still, the fact that there are only two stories to interact with means that all but the youngest raconteurs are liable to quickly yearn for more.

—Gayle C.
Ehrenman

My Computer Diary for Windows

Stone & Associates;
800-733-1263, 619-693-6333.

Circle 484 on reader service card



My Computer Diary attempts to teach preteen girls about writing, computers, and the works of famous women in history. Unfortunately, the effort falls short of its aim.

The product itself is simple. It's a digital, password-protected diary—with some extras, including a calendar, daily planner, and time line where you can record events, holidays, and goals. There's also a

searchable database of Women in History. In addition to these biographies, there are Affirmations and Questions, inspirational offerings designed to get you thinking about ideas for your writing and about such other topics as growing up, self-esteem, and family.

The problem here lies in the execution. The word processor is so simple that you can't cut, paste, set margins, or change fonts. Worse, you can't work in two parts of the program at once; you have to close the time line, for instance, before you can write your journal entry. Many of the grievously brief *Women in History* entries contain grammatical errors and spelling mistakes. And, despite the lip service paid to feminism, there are far too many flowers and first kisses in the packaging and in the documentation.

My Computer **how to de**
Diary doesn't com-
pletely miss the mark. Girls do
love their diaries—and what's
more, harkening to one of the

oldest and greatest literary traditions among women is a promising way to introduce them to writing and women's history. Nonetheless, shabby use of editorial material and poor technological implementation cause this product to fall far short of its potential.

—*Eryn Brown*

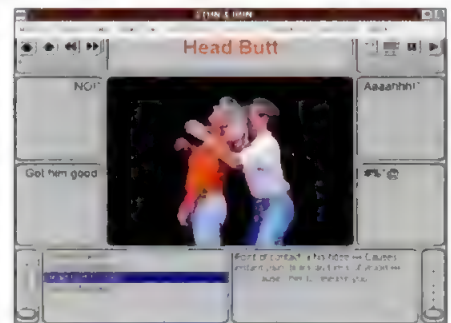
Stun & Run

WinMicro Corp., 800-538-6491.

Circle 485 on reader service card



Considering the sobering fact that the crime rate is soaring in America, chances are



Stun & Run uses still images to teach women how to defend themselves from attack.

you've contemplated learning self-defense at one time or another. For those who have trouble fitting organized class sessions into their schedule, Stun & Run offers a viable solution.

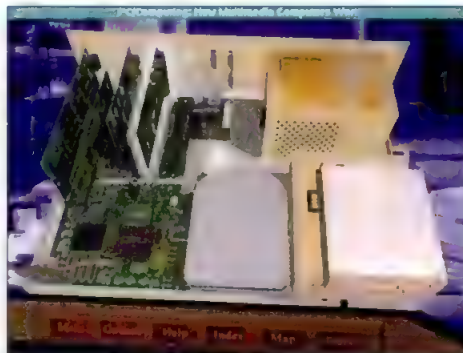
This package, which was produced by personal-security trainers, provides a comprehensive approach to preparing you for most crime situations. There's a range of safety tips, advising you on such things as the safe use of automatic teller machines and how to safeguard against carjackings. There's even a section with precautions you can pass on to your children. Most of these tips are common sense—for example, "Never leave bags unattended in an airport"—but a few border on paranoia, such as the proposal that you consider

PC/Computing

How Multimedia Computers Work

Ever wonder exactly how your multimedia-ready PC does all those wondrous things? This disk, which is based on the Ziff-Davis Press book of the same name, uses 3-D animations and descriptive narration to explain just what happens in that magic box.

**PICK
HIT** This disk makes newcomers feel instantly at ease by using familiar metaphors, such as the desk that is your home base. On this desk rests the IBM-compatible multimedia PC you're going to explore. Just click on an object—the CD-ROM drive, for example—to launch an animated explanation of that device and how it operates. Alternatively, you can embark on one



of the guided tours, such as Booting Up, to find out about a process.

If you're tired of thinking of your PC as a mysterious device, this is the disk for you.—Peter Scisco
The Software Toolworks: 415-883-3000.

Circle 509 on reader service card



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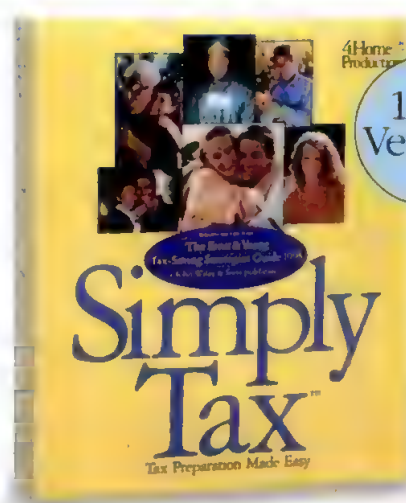
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DOOM

On CD-ROM and
3.5" disks for IBM
& Compatibles



Hell on Earth is here. Rejoice.

In the annals of computer entertainment, there's no game that had the rave following quite like DOOM.

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once you start playing **DOOM II**.

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If you've played DOOM, stop reading and haul ass to the nearest game store *now*. If you haven't, we can only say (respectfully, of course): Go to hell.

id
SOFTWARE

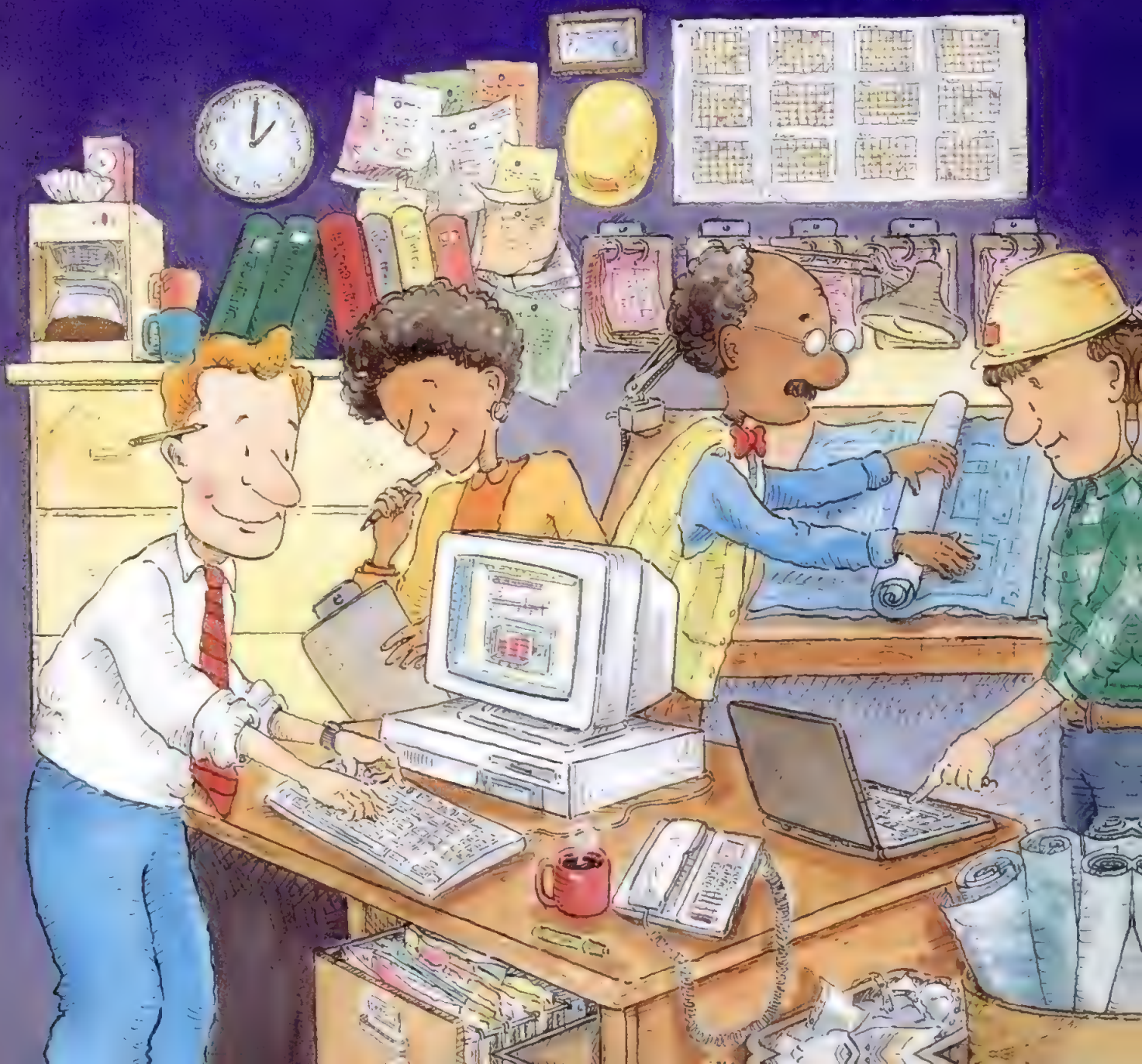
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Here Are 3 Constructive Ways To Improve Your Productivity.



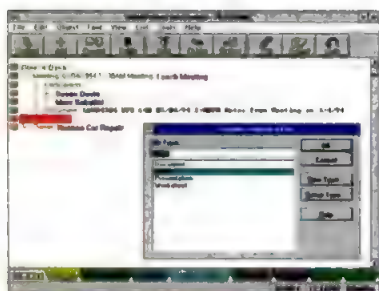
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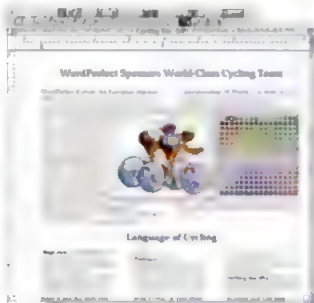
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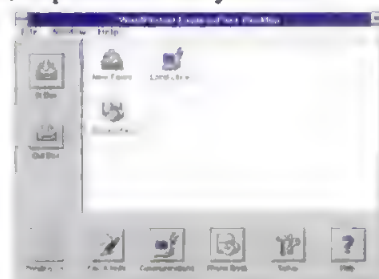
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shopping from catalogs in lieu of leaving your home.

This program's strength is that it brings together a wealth of valuable information in one place and joins that information with visual aids. Included are a primer on crime statistics and a psychology lesson emphasizing that you, the victim, need not be victimized; another section offers details on fighting alternatives. Step-by-step photos demonstrate a variety of attacks and techniques for self-defense. Look for an upcoming CD-ROM release of this product to add full-motion video and a greatly enhanced interface.

Though Stun & Run can't take the place of live instruction in self-defense methods, this program provides a great alternative that will give you the basic knowledge you'll need to fight back.

—Melissa J. Perenson

Reference

A CD-ROM of Her Own

Her Heritage: A Biographical Encyclopedia of Famous American Women

Pilgrim New Media Inc.;

617-491-7660.

Circle 486 on reader service card

★★★★WPN \$49.95

The software choices for women are even fewer than they are for girls. Look beyond the traditional disciplines of gardening and sewing, and the field narrows further. But Pilgrim New Media is out to even the score with Her Heritage: A Biographical Encyclopedia of Famous American Women, the first in a planned series of women-centric CD-ROMs.

The title of the disk offers an accurate description of its subject matter but can't begin to describe its depth. There are over 1,000 entries included here; biographies include yesteryear's well-known women as well as today's headlining celebrities. Still other entries reclaim women whose names and exploits have been all but forgotten—for instance, former slave and poet Phillis Wheatley.

The entries feature text, pictures, and, in some cases, video footage. Don't miss the newsreel footage of Annie Oakley demonstrating a trick shot or the video clip of Gypsy Rose Lee explaining what a fan dancer does. (Don't worry—she keeps it clean!)



Read about famous women of stage, screen, and history with Her Heritage.

You can browse through the listings alphabetically, by avocation or vocation, or by name—however you prefer. There's also a Timeline of women's accomplishments and a listing of Pseudonyms and Pen Names.

Her Heritage is rich and bountiful, as is the history of women's accomplishments. If only there were more titles like this.

—Gayle C. Ehrenman

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Reference

Uncork and Allow to Breathe

Wines of the World

Multicom Publishing Inc.;
206-622-5530.

Circle 487 on reader service card

★★★★    \$59.95

It may all be made of grapes, but for the enthusiast, wine is a complicated thing. This multimedia CD-ROM provides all the history, rituals, and statistics of viticulture a novice needs.

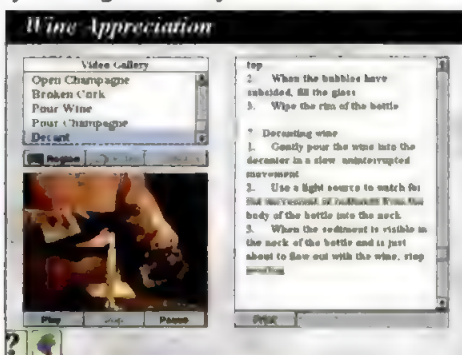
All of the information is presented in an engaging fashion. The many photographs and video clips range from the purely amusing to the truly informa-

tive. So you can watch two very different video clips on the same subject. One clip demonstrates how to open a Champagne bottle safely; the other shows how to open Champagne as Napoleon would have—with a saber. Or you can listen to the personal observations of a vintner.

The Wine Region module casts a wide net that encompasses the major players, such as France and Italy, as well as relatively unknown wine-producing countries. The information here is top-rate and up-to-date—little wonder since Wines of the

World is based on the book *The Companion to Wine*, written by New York Times wine critic Frank Priol and others.

The other modules, Wine Quality, Wine Appreciation, and Wine Browser, are a mixed bag. Great fea-



Wines of the World's digital videos explain procedures, such as decanting an old wine.

QUICK CLIPS

Recommended
It's Your Call
Not Recommended

Beauty and the Beast Be Our Guest

Yup, it's Beauty, Beast, and a bevy of skill games that are probably too baffling for your average seven-year-old. \$24.95. Walt Disney Computer Software Inc., 818-543-4300.

Clark Howard's Consumer Survival Kit

Who is this "consumer guru" and why should anyone pay this much for a CD-ROM full of his common-sense tips? \$79.95. The Mescon Group, 404-656-1929.

Crossword Wizard

Can you think of a nine-letter word that means great and starts with the letter E? That's the best description for this never-ending source of original, customizable crosswords. \$49.95. Cogix Corp., 800-455-3388, 415-454-7217.

Lights Out: Collegiate

A screen saver full of flying team logos and a blimp that devours them. At this price, even die-hard sports junkies should demand more than one NCAA conference and mediocre graphics. \$49. Quadrangle Software, 313-769-1675.

tures, such as a visual guide that shows you how to read wine labels, are offset by text blocks that are often too long for comfortable on-screen reading. And while it's wonderful to delve into a database of 20,000 items using search criteria such as producer, price, and vintage, the Wine Browser is limited to American varietals, Bordeaux,

and Port only—literally excluding a world of wine.

The real world of wine is far too complex to fit on a single CD, but for neophytes eager for their first sip of wine knowledge, this disk is hard to top. Experienced connoisseurs should just uncork a bottle of Bordeaux instead.

—Luisa Simone

SPOTLIGHT ON GADGETS

ComfyKeyboard

Kids and computers may be nothing new, but computer toys that little ones can work all by themselves are something of a departure. The ComfyKeyboard (which plugs into the PC's parallel port) resembles a child's "busy box," with a telephone, brightly colored push-tabs, buttons, and a cylinder roller. Your child uses the proprietary keyboard to interact with characters in the included ComfyLand Interactive Movies.

In ComfyLand, your child meets the boy Comfy, his dog Jumpy, Snaily the postman, and assorted friends. Each character has a story to tell, and they

speak slowly and clearly, frequently addressing your child directly. For example, Comfy asks your child to telephone Snaily to come help the lion at the zoo.



The keyboard is active even when the characters aren't making requests. For example, color tabs tint the current scene, and pressing the sun, moon, or cloud button triggers one of several educational mini-movies. After each interruption, the story picks up where it left off.

Two-year-olds will love having their own keyboard, and as they grow, they'll do more interacting with the story and less interrupting. By the time they outgrow ComfyLand, they'll be ready to use the "grown-up" keyboard.

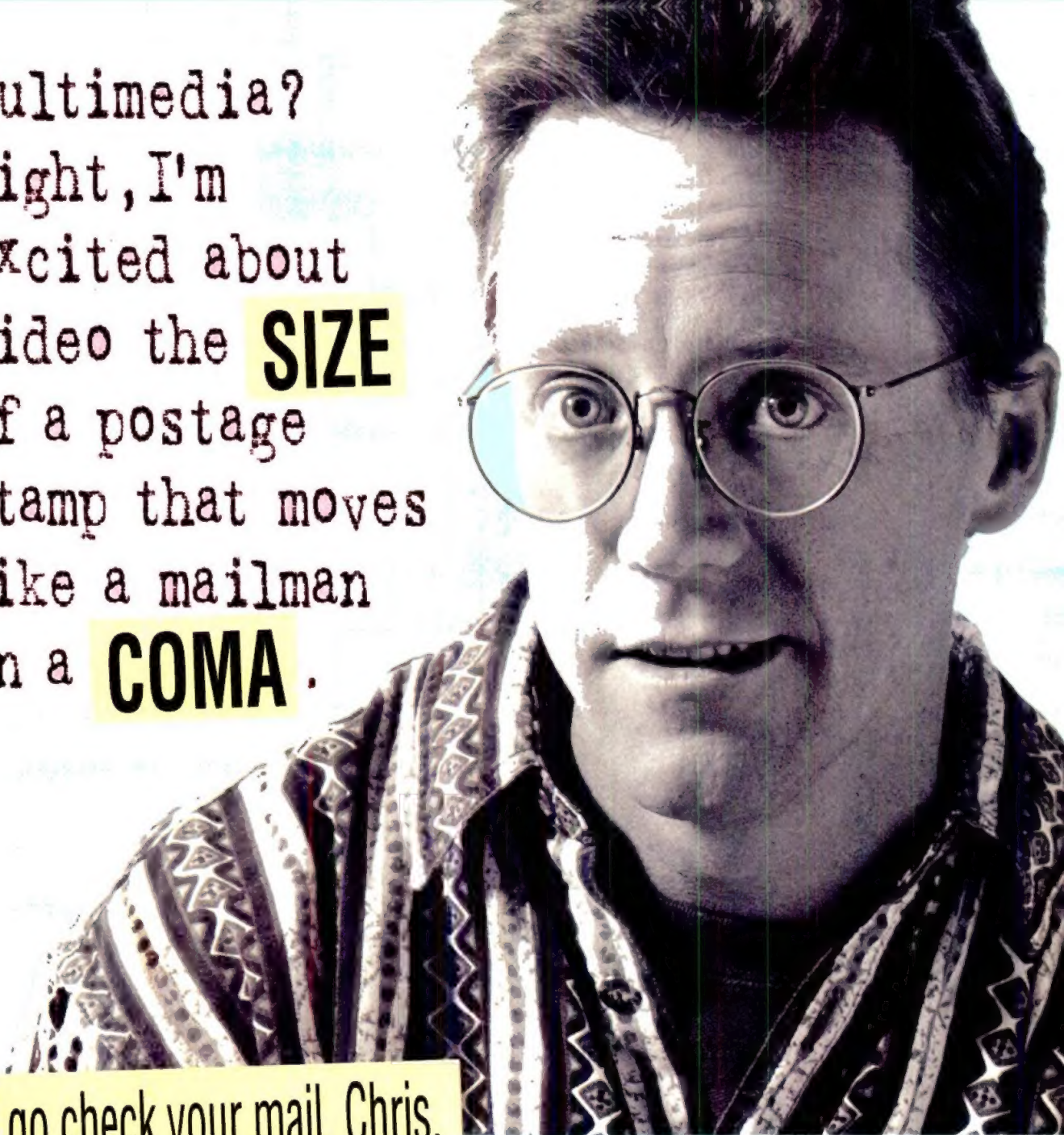
—Neil J. Rubenking

Comfy Interactive Movies Ltd.; 800-992-6639, 408-733-6713.

Circle 510 on reader service card

★★★★    \$129

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of a postage
stamp that moves
like a mailman
in a **COMA**.

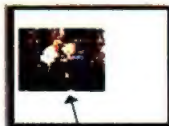


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By Don Willmott

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Tech Support Corner



thesizer with another synthesizer. But the engineers at Turtle Beach Systems only suggest you do this if you totally lose your mind and suddenly gain an interest in using an inferior product."

—TURTLE BEACH SYSTEMS DOCUMENTATION

Q: When I copy a 256+ color

What a coincidence! DataSafe Publications' programming staff looks just like AccuSoft's tech-support staff.

ARF on the road: São Paulo, Brazil. (Cabeleireiro means "hairstylist" in Portuguese.)

"The time to buy is now."
—COMPUTER SHOPPER,
AUGUST 1994, PAGE 168.

"Trends & Technology. Double- and triple-speed CD-ROM drives head for the junkyard."

—COMPUTER SHOPPER,
AUGUST 1994, PAGE 61.

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"Hello, tech support? My keyboard doesn't seem to be working."
(Premier magazine.)



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Richard Tennant

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FOCUS GROUP, LOS ANGELES, 1994

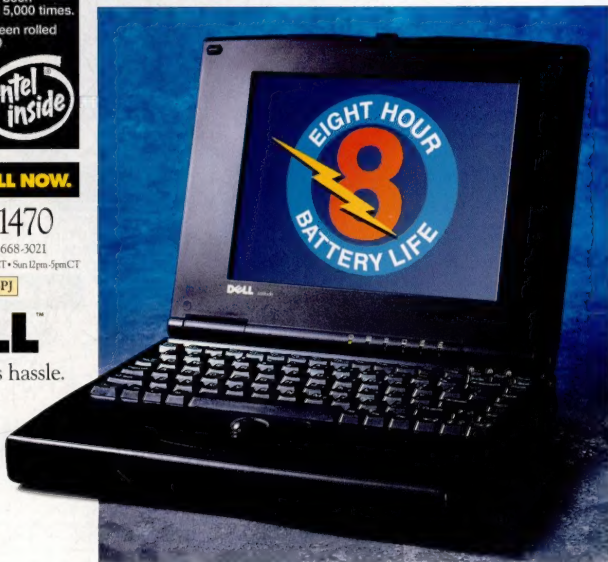
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